SCIENTIFIC AMERICAN

Moving Pictures Under Water
Cleveland Battles Against the House-Fly
An English Transatlantic Flier

Vol. CXI. No. 2
July 11, 1914

Munn & Co., Inc., Publishers
New York, N. Y.

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$3.00 A Year

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SEVENTIETH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXI] NUMBER 2. NEW YORK, JULY 11, 1914 [PRICE 10 CENTS $3.00 A YEAR

A Boy's Model of a Battleship

By William N. Hardy

SAMUEL ORKIN, a Boston boy, who has been in this country but nine years, has built a battleship model, which because of its wonderful detail and suggestions for invention has won the personal praise of Secretary of the Navy Josephus Daniels. Orkin has spent eighteen months perfecting his model. It is nine feet long and about 20 inches wide and, except for suggestions for improvements as a model, it is a duplicate of the superdreadnoughts, "Arkansas," "Wyoming," and "Texas."

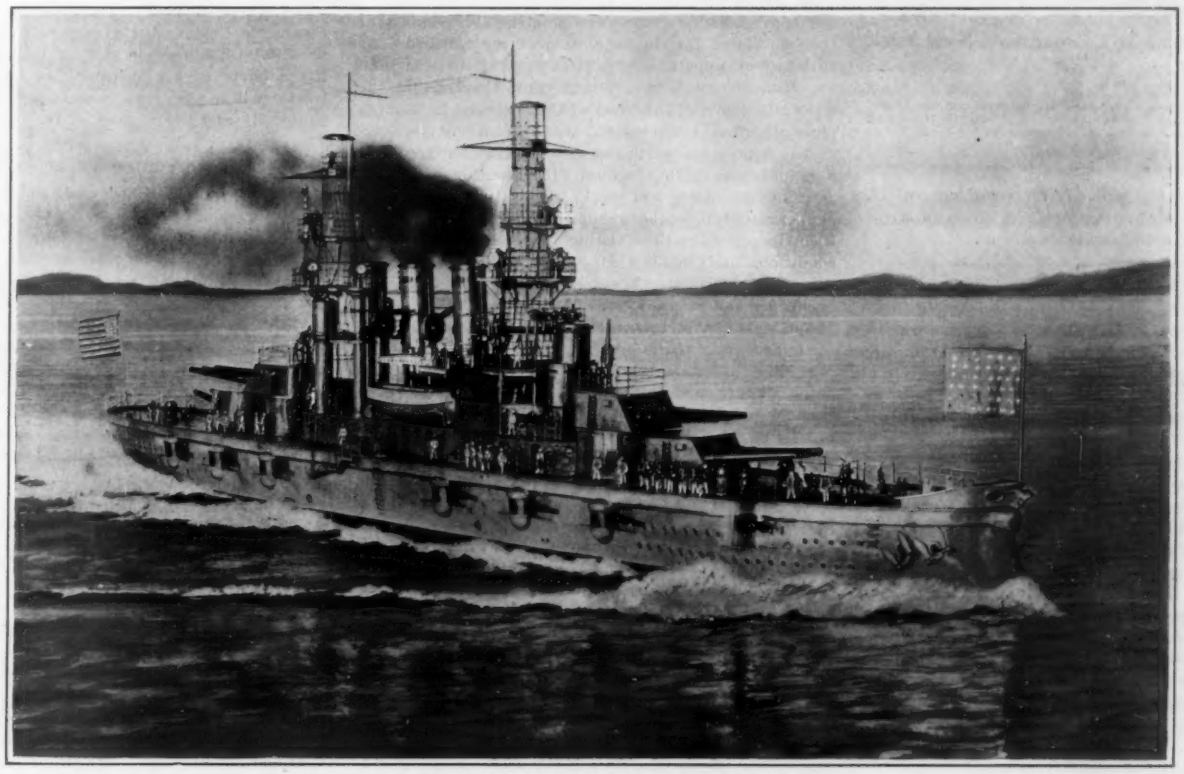
Orkin has arranged a system of endless chains under the decks, so that when the boat is in action miniature sailors pace back and forth, opening doors of the cabin and closing them as they come out, and saluting superiors as they pass them. Flags on the forward and aft decks are hoisted and lowered at frequent intervals, the anchor is hauled up and lowered, and as often as is desired a phonographic arrangement below sends forth the strains of "The American Patrol." While this is going on a band makes its appearance on the aft-deck and when the music stops the bandmen march off.

Guns boom at stated intervals and the firing can be kept up for three minutes steadily. Smoke is forced out of the guns, so that a realistic touch is added. There are three smokestacks, as in the "Connecticut," which at frequent intervals pour out black clouds, as though stokers were at work in the stokeholes below.

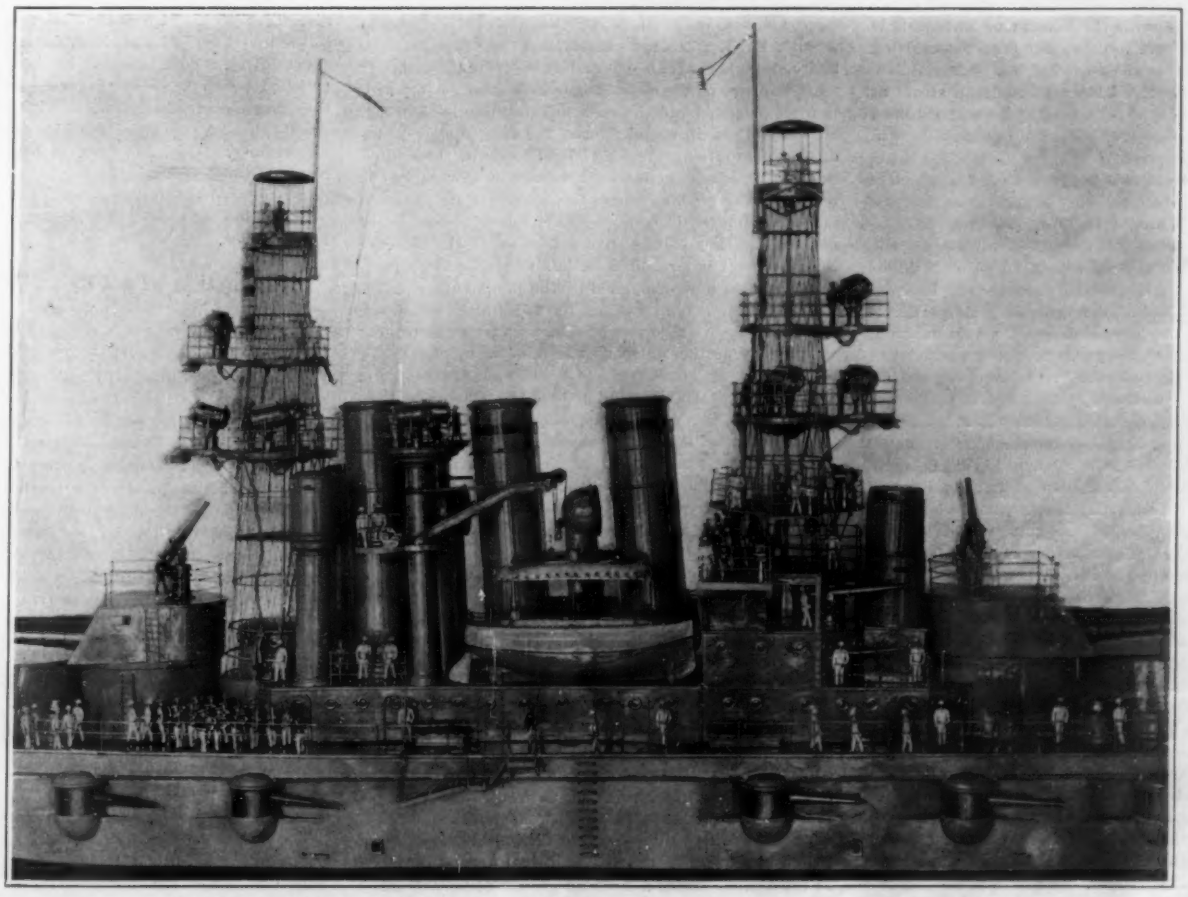
The model is equipped with three guns to a turret. There are eight torpedo tubes. The turrets are so arranged that all the big guns can be trained on the same spot at once and fired, or they can be fired in different directions if desired.

There are two one-pound semi-automatic guns, and two aeroplane guns, Krupp's model. Six miniature sailors man each of the aeroplane guns and there are two at each of the others. There is a magazine capacity of 1,000 cartridges of 0.38 and 0.22 caliber, and 250 shots can be fired from the semi-automatics without reloading. Another feature of the boat is an array of 15 searchlights, which Orkin made himself. The craft is automatically steered. He can put the craft in a lake and keep it going in all directions for half an hour or longer.

The motive power for the boat and novel equipment is supplied by seven electric motors, especially designed, and the current is furnished by an eight-volt storage battery designed especially for maintaining a steady voltage.



Working model of a battleship built by a boy.



Detail view of the battleship, showing moving crew, band, armament, and electric searchlights.

A two-year-old plantation of Douglas fir on the Oregon national forest shows 94 per cent of the trees living. Extensive plantings of young trees in Washington and Oregon are costing only $8 an acre. Direct seeding of lodgepole pine has been successful without exception on the Arapaho national forest, Colorado. Several of the areas sowa two and three years ago show from five thousand to ten thousand seedlings per acre.

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Battleship Versus Submarine and Aeroplane

SIR PERCY SCOTT, to whom perhaps more than to anyone else the great punishing power of the modern battleship is due, has proclaimed in a London daily that the day of the battleship is over, having been brought to a close by the deadly efficiency of the aeroplane and the submarine.

If the gallant admiral had made this statement in an after-dinner speech, we could have understood it. Some day Sir Percy's statement may hold true; that it is true to-day will be stoutly disputed by ninety-nine out of every hundred naval officers and expert lay writers on naval topics.

As a matter of fact, in spite of their remarkable accomplishments, both the aeroplane and the submarine are not yet far removed from the embryonic stage. As for the aeroplane and the airship, we are inclined to doubt that they will ever be a serious menace to a battleship fleet maneuvering upon the high seas; for under these conditions the range and accuracy of modern gun fire will prevent aerial "navies" from coming within effective bomb-dropping range.

The menace of the submarine, however, is really serious; but not in its present Lilliputian stage of development. The trouble with the submarine is that it is altogether too small and too slow for deep-sea cruising and for the fighting of deep-sea battles. When it has reached a displacement of 3,000 tons and can steam at destroyer speed, the type will realize its unquestioned latent destructive power. Then the battleship will have to look to its laurels.

For many years we have believed that the effective answer to the battleship will be, not the submarine, but the submersible. It would be quite possible, even to-day, to build a submersible, designed always to run awash, of 3,000 to 3,500 tons, with a speed of 27 knots and carrying five torpedo tubes arranged in its nose for end-on fire. Oil fired boilers, small, high-speed turbines, and mechanical reduction gear, would make it possible to put the necessary power into a submersible of this displacement, and still leave room for the accommodation of the necessary ammunition and crew. Such a ship, carrying a curved 6-inch deck, would be able to make a quick dash across the modern 10,000 yard fighting range between two battleship fleets, without the enemy having one chance in one hundred of stopping it. At 27 knots, the range would change so rapidly that the sighting of the guns would be haphazard; and so flat is the trajectory of modern projectiles, that if by chance they hit, they would strike well within the minimum angle of thirty degrees, below which penetration is impossible and the shell glances off. Such a submersible (which would merely be a refined and enlarged Ammen ram, using the torpedo in place of the ram) would be certain to get within point-blank range of 1,500 to 2,000 yards, at which it could make sure of driving every one of its five torpedoes against the hull of the battleship selected for attack.

The nation which first develops a craft of this size, speed, and power will gain a lead over all other nations, and will produce a revolution in naval construction, greater than that which occurred when Great Britain put out the first dreadnought.

Over-regulating the Railroads

IT is always possible to carry a good thing too far, and we believe that this has been done in the matter of government regulation of the railroads. As our readers are well aware, the SCIENTIFIC AMERICAN was an earnest advocate of the formation of the Interstate Commerce Commission, and from time to time has strongly urged the strengthening of the hands of the Commission to the extent of enabling it not only to recommend, but to enforce such changes and improvements as it thought necessary.

For the present at least, the Interstate Commerce Commission may well rest on its laurels; and in proof of this it is necessary only to refer to its work in bringing about the universal use of the automatic car coupler and the air brake; its promotion of automatic block signaling and the automatic train stop; its efficient organization for the expert examination and analysis of train accidents; and, lastly, its notable work in the prevention of rebates and in the general regulation of interstate commerce.

So far, so good.

To-day, however, there are unmistakable signs that this movement for the regulation of the railroads has gathered an impetus which is carrying it too fast and too far. There is a growing conviction among the wiser and more level-headed of the men who have given close attention to the matter, that reform has been carried to a point at which the railroads are not receiving a "square deal." We refer to the question of freight rates and the request of the Eastern railroads that they be permitted to make a sufficient increase to enable them to maintain the existing properties in first-class condition, and make such extensions as the rapid growth of the country in population, industry, and commerce demands.

The most convincing arguments on behalf of the railroads are those of the lately-appointed president of the New York, New Haven and Hartford Railroad Company, Mr. Howard Elliott; and the following facts, as recently put forward by him in a public utterance, are worthy of most thorough consideration.

There can be no doubt whatever that there is an intimate relation between the prosperity of the railroads and the prosperity of the country at large. The transportation business in the United States comes second in importance among the great commercial interests of the country. According to the last census, there were over forty-one billion dollars invested in agriculture, about twenty billions invested in transportation, and about nineteen billions in manufacture. The interests of the three are so closely inter-related that they must rise and fall together. If we were asked to name the particular one upon which the prosperity of the country most nearly depended, we should unhesitatingly name the railroads. For of what avail are huge crops and a vast output of manufactures, if the railroads are unable to distribute them swiftly and economically between producer and consumer?

In an article recently published in the Chicago *Herald*, Mr. Elliott draws attention to the fact that the railroad is never finished and cannot stand still. It must improve or depreciate; and if it is to go forward, that means a constant investment every day in the year. He states that, in round figures, for every dollar in increase of gross earnings of the railroads of the United States as a whole, at least six dollars of new capital is required, and he asks where the railroads are going to get this money. They must either save it, earn it, or borrow it. They cannot save it because of the increase in the cost of labor and materials and the more luxurious facilities now demanded by the public, and because the law-givers, representing the public, have shown little tendency to give any help in the way of increasing the price that the railroads are allowed to charge for their service. Thus, for the year ending June 30th, 1914, the New Haven road paid $2,500,000 more than they did for the year ending June 30th, 1910, for the same amount of labor. This alone represents 5 per cent on $50,000,000. Again, if the New Haven could have obtained the same rates of wages in 1913 as it did in 1903, its payroll would have been $7,200,000 less.

Coincidentally with these increasing expenses, there has been a fall in freight rates. If the New Haven had received the same freight rates in 1913 as it did in 1903, it would have received for the same service $1,800,000 more. These two items represent a difference of $9,000,000. Furthermore, although in twenty years railroad taxes have increased 225 per cent, there has been no corresponding increase in freight rates.

The argument for giving the railroads a square deal in this matter of freight rates becomes absolutely unanswerable, when we bear in mind the fact that the construction and operation of our railroads have been, and are now being carried on so efficiently and at so low a cost, as to make them the wonder and admiration of foreign railroad companies. That this is no exaggeration is proved by the cold statistical figures. We have in the United States a railroad system of 250,000 miles, which has been built so economically that the capital invested represents only $60,000 per mile; whereas in England it represents $273,000 per mile, and in Germany $114,000 per mile. The average pay of the employees of our railroads is $733 per year, as compared with an average pay of $270 per year in England and $388 per year in Germany. But it is when we come to the matter of freight rates that the economical operation of our railroad system stands out most brilliantly conspicuous; for whereas the average charge against the people of the United States for hauling 2,000 pounds one mile is three quarters of a cent, it is 2½ cents in England and 1½ cents in Germany. In other words, we have built up our railroads for less than one fourth of the cost per mile of the English railroads, we pay our employees over two and one half times as much in wages per man, and yet we are carrying freight at one third the rate charged in that country.

No one who is in the least acquainted with the railroad situation and the agitation for government control will accuse Mr. Brandeis of undue partiality for the railroad side of this question. Very significant, then, was a statement in his brief presented to the Interstate Commerce Commission at the rate hearings, in which he said, "On the whole, the net income and net operating revenue of the railroads in official classification territory is smaller than is consistent with their assured prosperity and the welfare of the community."

The Tercentenary of Logarithms

"EFFICIENCY" and "labor-saving" are the slogans of to-day. Yet one of the greatest and certainly one of the most ingenious labor-saving devices is this year celebrating its three-hundredth anniversary. Perhaps only an astronomer can fully appreciate the significance of the discovery in 1614, by John Napier, of a system of logarithms. Without logarithms it is doubtful whether Kepler could, in his lifetime, have completed the calculations which led to the formulation of "Kepler's laws," and Newton would thus have been deprived of the principal basis from which to derive his inverse square law of gravitation. And without logarithms the computations of modern astronomy would be utterly impossible.

If the intensity of the astronomer's need for logarithms is the more acute, the total volume of their utility is perhaps greatest to the engineering profession, which, of course, far outnumbers the rather small group of the world's astronomers. True, the engineer often finds the slide rule sufficient for his needs, but the slide rule is merely a mechanical adaptation of logarithms. The only practical substitute for a table of logarithms is a calculating machine. But a good machine of this kind costs several hundred dollars. A table of logarithms can be procured for a few cents.

It is sometimes said that great discoveries and inventions have always come just when the time is ripe for them, and that if one man had not made the decisive step in advance, another would have done so almost as soon. In a sense, this may be said to apply to the invention of logarithms, for a Swiss watchmaker, Jobst Bürgi, a contemporary of John Napier, independently prepared a similar set of tables, also involving the principle of logarithms. Which of the two, Napier or Bürgi, first conceived the idea is a matter of some uncertainty. This, however, is beyond question, that Napier's work was much more perfect, and that Bürgi never realized the full significance of his discovery. In point of date of publication Napier has about six years in his favor.

Elimination of a City's Filth and Flies

THE fly does its deadly work of carrying disease germs to food so stealthily that man has been wholly unsuspecting. Even when he does learn the truth, it is difficult to believe the treachery of an animal that has lived for centuries in such intimate relationship with mankind. Had man been less trusting, the repeated accounts of the association of flies with plagues and pestilence recorded in the Bible might have caused him to learn the truth long before he did.

Knowledge of the fly's deadliness and belief in the possibility of ridding our habitations of the fly pest must precede action. But how can that knowledge and that belief be instilled? On another page of this issue will be found an instructive article, which tells how the problem was successfully attacked in the city of Cleveland. From the first the idea uppermost in the minds of those who led the Cleveland campaign, has been to unite the efforts of the whole community to do the team-work, as it were, in destroying the fly. So successful was the plan adopted that confessions on all sides were heard that the reduction of the flies in the past summer had led many people to change their minds on the ultimate elimination of flies from the city. The conversion of business men, especially those dealing in food products, was gratifying because the burden of the work naturally falls on the men whose merchandise is attractive to flies.

Engineering

Geared Turbine Liners.—The "Transylvania," the largest steamship to be equipped with mechanical reduction gear, was recently launched for the Anchor Line. She is of over 14,000 tons gross, and will have twin screws driven by Parsons turbines through helical gearing. A sister ship, the "Tuscania," is being built for the same service.

A Ten-Million Cubic Feet Gas-Holder.—What is believed to be the largest of the many huge gas-holders in existence, is one completed in 1910 for the Newtown Gas Company, Borough of Queens, New York city. The holder is 251 feet in diameter and 275 feet high. Such is the height of this vast cylinder that it is a familiar landmark for many miles around New York city.

The Fottinger Transformer.—It is stated that the Föttinger hydraulic transformer, or reduction gear, is receiving a wide application in Germany. The Vulcan Company are equipping the new Imperial yacht "Ersatz Hohenzollern," of 7,000 horse-power, the cruiser "Ersatz Gefion," of 45,000 horse-power, and three German destroyers with a total of 75,000 horse-power with this type of reduction gear.

Magnitude of the Culebra Slides.—It is estimated that altogether 250 acres of ground lying outside of the prism of the Panama Canal, and containing over 30,000,000 cubic yards of material, have swept down into the canal. This material would be sufficient to build a wall seven feet thick and seven feet high, reaching from New York to San Francisco, and it would fill a million and a half of the big Lidgerwood cars, making a train that would extend for a distance of twelve thousand miles.

Trial Trip Results of the "Vaterland."—We have received the official statistics of the results obtained on the trial trip of the "Vaterland." The displacement of the ship was 58,500 tons, and, on this displacement, with a horse-power of 90,700, the ship made an average of 25.84 knots for four hours. To accomplish this, the whole of the battery of 46 boilers was in use. On her maiden trip, the displacement varied from 63,500 to 56,000 tons, and the average horse-power was 63,000.

The Reliability of Modern Heavy Ordnance.—As showing the excellent workmanship which goes into the modern heavy naval gun, it may be noted that the whole of the 15-inch guns for the five British battleships of the Queen Elizabeth type were ordered without any trial gun being made and tested. When the first 15-inch gun was tried out, the results agreed exactly with the calculations of the designer. It is stated that it is the best and most accurate gun of all ranges that has yet been built for the British navy. The explosive charge of the shell, which weighs nearly 2,000 pounds, is 50 per cent larger than that of the 13.5-inch guns which preceded it.

Sloop versus Cutter Rig.—It is interesting to note that in both the challenging English and the defending American yachts, in this year's contest for the America's Cup, there is a tendency to return to one of the distinguishing characteristics of the original "sloop" rig. We refer to the use of a single head rig. The first adoption of the cutter rig by the defending yachts occurred in the "Puritan"—"Genesta" races of 1885, when the "Puritan" carried both jib and foresail. The shifting of the mast forward in modern "single-stickers," has brought back the single head rig. "Resolute," "Defiance" and "Shamrock IV." have tried it, but "Resolute" and "Shamrock IV." have returned to the cutter rig. "Vanitie" is cutter rigged and will remain so.

Anchoring Houses in Flood Districts forms the subject of a useful circular issued by the Texas Agricultural Stations (P. O.: College Station, Brazos Co., Tex.). Its publication is timely, in view of the many houses that were carried away by recent floods on the Brazos and Colorado Rivers. Similar occurrences are, of course, common in all great floods, and cause much loss of life, as well as of property. The circular in question gives detailed descriptions and drawings, together with estimates of cost, for two kinds of pier for anchoring houses in bottom lands. The simpler device consists of an upright post standing on two horizontal posts forming a cross, and buried six feet in the ground; the whole being tied together and to the floor of the house with an iron rod. The other plan provides for a pier of reinforced concrete.

The Failure of the Hatchtown Reservoir, Utah.—On the night of May 25th, the Hatchtown Reservoir, on the Sevier River, Utah, 220 miles south of Salt Lake City, failed. According to *Engineering News*, the leakage was noted by the watchman at the downstream toe of the dam, near the end of the outlet culvert. This developed into several small streams; and, later, large sections of the lower face began to slip off and wash away. At 7:30 in the evening, from 100 to 140 feet of the dam went out, releasing over 500,000 cubic feet of water, which had a depth at the point of failure of 53 feet. The immediate cause of the break was leakage along the outer surface of the outlet culvert. The dam has a maximum height of 60 feet deep, and a length along the crest of 780 feet. The dam was built of earth.

Electricity

Electrolytic Iron.—It has taken quite a while to make electrolytic iron of use in the industries, because it was filled with hydrogen due to the action of the current in the process. This makes it brittle and unsuitable for practical work, so that inventors have been trying to get rid of the hydrogen and to make a metal of the usual quality. At the coming Lyons Exhibition, samples of the new iron are to be presented, in the shape of seamless iron pipe, which possesses great tenacity and ductility.

Moving the Western Union Telegraph Station.—The old building, which has housed the Western Union Telegraph Company in New York since 1875, is now being taken down to make room for a more modern structure. The telegraph company has moved to new quarters. Moving a large station such as this, with 2,500 wires and over a thousand employees handling 150,000 messages per day, was no small matter. Promptly at midnight on Saturday, June 27th, the moving commenced. During the slack hours of Sunday the transfer was completed, and the operators had a chance to become acquainted with their new surroundings.

Wireless Finder for Fog-Bound Boats.—The steamer "Royal George," of the Canadian Northern has been equipped with a Marconi-Bellini-Tosi radio-goinometer which will enable it to determine the direction of an approaching steamer, provided it is sending out radiotelegraph signals. This consists of two triangular aerials, bisecting each other at right angles. In the base of each triangle is a coil. These crossed coils constitute the primaries of a transformer of which the secondary is a pivoted coil connected with the receiving detector. The secondary coil is turned to the position that produces the loudest signals in the receiver, when it will point directly at the source of the waves. A number of other vessels have been equipped with this apparatus in the past few years. It should prove invaluable in a fog when the direction of sound signals is so uncertain.

Extracting Casein Electrolytically.—An electrolytic process now serves to extract casein from milk, according to a French authority. This is carried out in the following way: In the center of a large tank full of skimmed milk and heated to 80 deg. Cent. place a porous vessel containing a 50 per cent solution of caustic soda, dipping into the porous vessel an iron cathode. For the anode, a carbon plate is immersed in the tank. The current causes the casein to be thrown down from the milk, and it is claimed that the new process is much more economical than those used hitherto; because the use of acids or rennet was necessary. Besides, casein thus prepared contains no foreign substances and is very pure. It serves, among others, to manufacture "galalith," which is a hard white material intended to replace celluloid, ivory, and the like.

Oxide-Insulated Copper Wire.—The use of the surface coat of oxide on aluminium wire in order to produce insulation for electrical purposes is gaining ground, and what is more, the process is now beginning to be applied to copper wire. As regards insulation, cotton, silk, rubber and the like are easily injured by heating. "Enameled" wire will not stand a heat of over 120 deg. Cent., as the coating has the nature of varnish. Asbestos is irregular, and too thick for many uses. We are familiar with the oxide coat on aluminium wire, and this gives an adherent, thin, flexible and good insulating layer. Recent tests made in German works show that such wire can stand a heat of 300 to 400 deg. Cent., and the layer of oxide adheres so strongly that the wire must be scraped with a knife in order to remove it. Electromagnets are now made with this wire, and it is also used for traction motors, etc. More recently, the same process serves for copper wire. Copper wire takes a coat of aluminium by a suitable process, then the surface is oxydized by dipping in a bath of ammonium borate.

The Electrocution of Noxious Insects.—A new machine has just been invented by an engineer, Mr. Friggeri, for the destruction of insects. This electric machine has been tried at Palacios, in the province of Santa Fe in the Argentine Republic. On a carriage that it is easy to transport, Mr. Friggeri places a gasolene motor and an alternating current generator. At the back of the carriage a drum is placed, on which about 200 meters of insulated cable have been rolled. This cable carries the current to a metallic net or system fixed upon a little vehicle with two wheels, and which carries in its center a transformer that is destined to raise the tension to 6,000 volts and even more. The metallic circuit is established between a pole and the dynamo formed by a stem of iron fixed into the ground and the net. After several trials, which have all been crowned with success, the experiments at Palacios were considered as decisive. Indeed, not only has it been possible to destroy the grasshoppers but also their eggs, which are to be found buried more than 9 centimeters deep in the ground. With the same apparatus provided with a metallic broom worked at the end of insulated handle, and which is joined to the positive pole of the transformer, it is also possible to completely clean the trees attacked by insect parasites.

Science

Gift to the Shackleton Expedition.—Sir James Caird, a Dundee millionaire, has just given the sum of £24,000 toward the expenses of Shackleton's forthcoming trans-antaretic expedition.

An International Institute for Geographical Exploration has been established at Christiania. It will include a laboratory for the equipment of exploring expeditions, and will devote special attention to polar research.

Production of Ultra-Violet Rays.—An economic method of producing ultra-violet rays has been described before the French Academy. The oscillating spark is used as the source of the rays, and for this the metal invar is better than aluminium. The energy is greater with invar. A great frequency is not necessary, twenty sparks per second furnishing good results.

Artificial Rubber Proposed as a By-Product of Steel Making.—It appears that at a recent meeting of the Iron and Steel Institute, in London, the president, in a paper on by-products in steel manufacture, discussed utilizing the gases of blast furnaces for sundry purposes, including the synthetic production of India rubber from coke oven gases, and stated that efforts were being made to obtain from coke oven gases the hydrocarbons, the derivatives of which were found in India rubber, and that experiments already made fore-shadowed manufacture of artificial rubber.

Prehistoric Man as a Sculptor.—Prof. Capitan now finds that prehistoric man was able to model in clay with considerable artistic skill. We are already familiar with the remarkable cave drawings of animals which were made at such epochs, but this appears to be the first time that we have evidence of models in relief. He found these in a cave in the Ariège district of France, and two bisons are thus reproduced in high relief. Among others, are engraved animals upon stones, all seeming to date from the Magdalenian epoch, or about 30,000 years ago. Animals instead of men were probably drawn for purposes of incantation, so as to give power over the animals, and some are seen pierced with an arrow.

A Scientific Study of Noise.—The question of different kinds of noises from a practical point of view, and with special reference to automobile horns was considered by Prof. Marage at a recent meeting of the Académie des Sciences. He investigated the subject by executing pieces of music upon ancient and modern instruments, before a number of persons chosen from all professions. The general result was that high-pitched sounds produced a more disagreeable impression than those of low pitch, and since it appears that the grave sounds are more agreeable to the ear he recommends that such sounds be used for signals as much as possible. In fact, the use of the siren has been prohibited in many European towns. He thinks that automobiles should have two kinds of signals, one a grave sound for city use which does not annoy the passers, and a loud and shrill sound for use in the country which sound will carry to a long distance.

Antarctica or Antarctia.—Although "Lippincott's Gazetteer" and the supplement to the "Century Cyclopedia of Names" define the name "Antarctica" as synonymous with "the Antarctic regions," or the whole area lying inside the Antarctic circle, no such use of this name is current among geographers, who (following, we believe, Sir John Murray) apply the name "Antarctica" to the supposed Antarctic continent. It is, of course, primarily a Latin adjective, meaning "antarctic," and when it is used as a noun we must understand with it the word "terra." Dr. Ludwig Mecking has recently urged the claims of "Antarctia" as a more satisfactory name for this continent, especially when it comes to forming a corresponding adjective. "Antarctia" and "Antarctian" are the natural analogues of "Australia" and "Australian," "Asia" and "Asian," etc. "America" is only an apparent exception, since it did not, of course, originate as a feminine Latin adjective.

The Effects of Sulphur on Plant Growth.—Sulphur is commonly used to protect vines from oidium, and it has long been noticed that, when thus used, it has a stimulating effect on the growth of the vines. The experiments of several French investigators have now made clear how this effect is brought about. Sulphur does not act directly as a plant food, but breaks down complex nitrogenous substances in the soil to the ammonia form. Hence its action is dependent upon the presence and amount of organic matter in the soil. Thus Vermorel and Dantony treated wheat and beans, grown in pots, with sulphur. When nitrogen was also applied in the form of nitrates the addition of sulphur led to no increase in yield, but when the same quantity of nitrogen was supplied in an organic form (dried blood) an increase of 30 per cent was noted for wheat and 60 per cent for beans. The most recent and conclusive experiments on this subject are those of Prof. Chauzit, at Villefranche-sur-Saône, where half-acre plots of vines were treated. The effects of the sulphur were markedly less in proportion to the time that had elapsed since the vines had been manured, and were increased by mixing the sulphur with the manure.

The Martinsyde Transatlantic Challenger Monoplane

An English Machine Designed to Compete for the Northcliffe Prize

By Major H. Bannerman-Phillips

THE late Mr. Gustav Hamel hoped to attempt a flight across the Atlantic Ocean this summer in an aeroplane built by Martin & Handasyde.

It was intended that the flight should be made from Newfoundland to Ireland, and the machine was to be ready for trial by the end of June or the beginning of July. Unfortunately, Mr. Hamel's untimely end has led to the abandonment of the entire scheme. The interest in transatlantic flying is such that a description of the machine should be placed on record. The machine was to be of the type, generally speaking, known as the Martinsyde monoplane, and was being constructed in duplicate at Brooklands at the cost of Mr. Mackay Edgar, the owner of the well-known motor-boat "Maple Leaf."

Mr. Hamel was to have been accompanied by an experienced navigator in the person of some officer of the merchant service who had made many transatlantic voyages, and under whose guidance Mr. Hamel proposed to fly in the track of the liners which are crossing regularly between Europe and North America, on the supposition that by following such a course he would seldom be out of sight of a ship. At a height of 1,000 to 1,500 feet any vessel within a radius of 30 miles should be visible in clear weather, and the height to which the machine could ascend was to carry it clear of the fogs on the Newfoundland Banks, which would otherwise have been troublesome at the start.

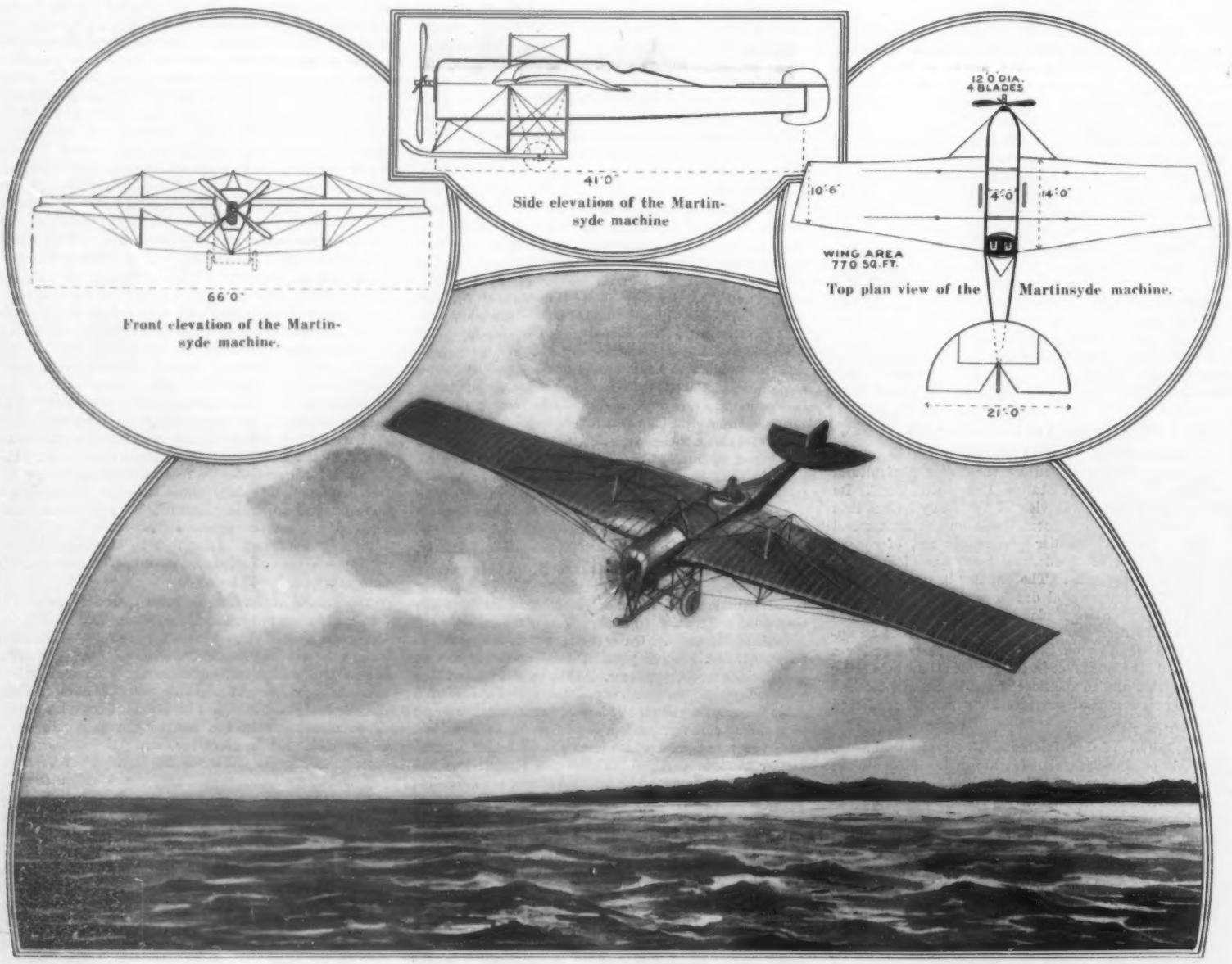
The estimated speed of the machine in calm weather was to have been 80 to 85 miles per hour, and fuel for 25 hours was to have been carried in a very large gasoline tank of 330 gallons capacity. This, with the wings and a watertight compartment, which in itself was to have a flotational capacity of nearly twice the full load of the machine, was calculated to be capable of sustaining the monoplane on the surface of the sea in case it should have had to come down in mid-Atlantic. There was no intention of descending, however, between start and finish unless necessity or accident compelled such a course. The machine was not a seaplane, and had no floats which would enable it to travel on the surface of the water. Even the wheeled chassis with which it was fitted to enable it to run along the ground in order to gather speed for its first leap into the air, was to be so constructed that the pilot, by pulling a lever, could cause it to drop clean off the fuselage, and thus reduce the useful load of the monoplane when once clear of the land. There would then remain for landing purposes a large central skid and two lower king-posts and skids, sufficient for the purpose, since the machine would be much lighter at the end of the journey than at the beginning, on account of the consumption of fuel, and therefore able to make a slow landing.

The accompanying illustrations may be considered to give a fairly correct idea of the monoplane as it would have appeared in mid-air over the Atlantic after the chassis had been dropped, but some items were still under consideration at the time of Hamel's disappearance. The span of the planes was 66 feet over all, of 14 feet 6 inches chord at the roots of the wings, tapering to 10 feet 6 inches at the tips, with a total surface of about 770 square feet, and the trailing edge was 3 feet longer than the leading edge. The plane section was peculiar in that the top of the wing between the spars, instead of following a continuous curve, was quite flat. The engine was to be a 12-cylinder Sunbeam of 215 horse-power nominal, which would drive a 4-bladed propeller of 12 feet diameter through a reduction gear. Covered in by a stream-line cowl, carried to the rear of the passengers' seats, the motor was to be fixed in the front of the fuselage. Behind this was a water-tight bulkhead or partition and a second similar bulkhead was fitted about 14 feet further back. Aft of this the construction of the fuselage was of the usual type, with the ordinary struts and braces, but exceptionally strong.

The seats for pilot and navigator were placed side by side, level with the trailing edge of the wings and at the after end of the 14-foot water-tight compartment formed by the two bulkheads. Near the forward end of this compartment the front spars of the wings cross the upper longerons of the fuselage and about midway the rear spars enter the latter beneath the longerons, the ends of the spars meeting on the center-line. From the points of entrance of the spars into the fuselage a couple of inverted struts started, which met on the central skid. These were to carry the main bracing wires of the wings. The gasoline tank was strung from the spar butts by means of a pair of longerons attached to them.

The system of wing-bracing was so designed as to make of the wings, together with both the upright and inverted struts, bracing-posts and bracing-wires a complete box-girder, with tension applied below as well as above the wings. This should have given a unit of great strength for the support of the main item of weight to be carried, namely, the huge gasoline tank with its contents. Compared with this the weight of the engine and the human freight was of minor importance. The total weight of the monoplane, fully

(Concluded on page 34.)



Front elevation of the Martinsyde machine.

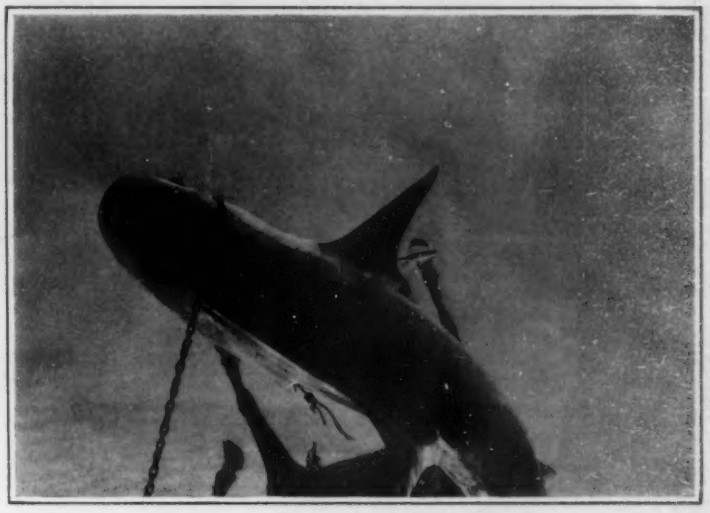
Side elevation of the Martinsyde machine

Top plan view of the Martinsyde machine.

The eighty-mile-an-hour monoplane which the late Gustav Hamel was to have used this summer in an attempt to fly across the Atlantic Ocean from North America to Europe.

Photos. copyright by J. E. Williamson.

An underwater fight with a shark.



A shark that was lured by a dead horse.

Taking Moving Pictures at the Bottom of the Ocean

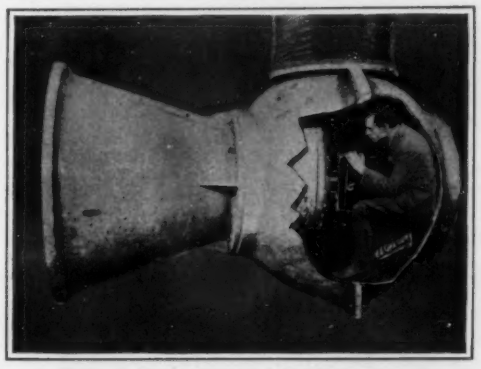
A Remarkable Photographic Feat and How It Was Accomplished

By J. E. Williamson

THE marvels that Jules Verne saw through the prehensile eyes of his vivid, Gallic imagination, the Williamson brothers are now seeing through the eye of a camera at the bottom of the sea. They have accomplished the conquest of the deep, with the aid of a novel submarine tube and of the photographic camera.

Twelve months ago the SCIENTIFIC AMERICAN published a group of remarkable snapshots made under the water at the bottom of Hampton Roads, Virginia, the first successful photographs ever made under the sea. This photographic accomplishment was notable, as it opened up to the eye of the camera a virgin field of startling significance—a field having a superficial area of 148,000,000 square miles. The submarine apparatus which made possible the easy access to this underwater world is most worthy of note, beginning, as it does, a new era of enterprise, reducing to a minimum the risk, and eliminating all physical strain. This device allows anyone to step from the deck of a vessel and climb down through an open airshaft to any desired depth, and there look and reach out and carry on, within limits, any work he may wish to accomplish. This invention, in its basic principle, is a revelation in marine construction, and is the invention of Charles Williamson, father of the present writer. Through its use the first practical submarine pictures were made, and in the past few months a marvelous motion-picture film has been produced with this apparatus—the Williamson submarine tube. Its flexible metallic construction makes a habitable hole in the water down and through which the camera man passes to his subaqueous studio to work for hours under normal atmospheric conditions.

I had been down in this tube, and from the work-chamber at its base looked through the port lights and had seen the fish in their native element. With experience gained as a newspaper photographer, my faculty for getting a news-picture was keenly developed, but it was not until the enormous possibilities of a motion-picture film of this new and fascinating realm were realized that the project of submarine photography was started. A few sleepless nights, and, with the co-operation of my brother, our plan of action was formulated. We knew the clear water of the tropics, abounding with plant and animal life, would be the place to obtain the best results. To fit out an expedition to go to these waters equipped with the necessary vessel, a powerful submarine lighting outfit, a Williamson tube and operating chamber for photographic work at its base, was a big undertaking. So it was necessary to carry on experiments near our home at Norfolk to prove that we were right in our assumptions and gain the interest and support of capital.

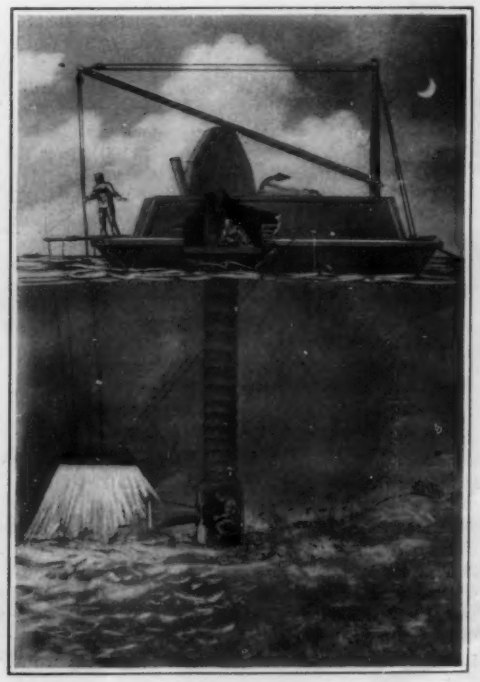


The underwater photographic gallery.

The organization of a corporation in Norfolk, Va., with T. S. Southgate as president, was the result of successful experiments that followed, and after seven months' work of preparation our expedition was in readiness for launching. We wanted the best motion-picture camera man for the important work to be done, and finally secured the services of Carl L. Gregory. With the West Indies as our destination, we started. Headquarters were made in the beautiful harbor of Nassau, in the Bahamas, and we made many trips from there to the nearby islands around whose treacherous coral reefs are found beneath the sea the beautiful, picturesque, and thrilling scenes we desired to capture and embalm forever on the retina of our deep-sea camera.

Pictures were made at night with the aid of our submarine lamps. They were each equipped with a 2,400 candle-power Cooper Hewitt quartz burner, and the results obtained, as the films show, are remarkably successful. The exposure used for these night pictures was about the same as that used in daytime, the average time of exposure being 100th part of a second. Wonderful results were obtained at various depths of from 15 to 60 feet. A striking example is shown on the cover of this issue; a diver snapped at work on an old wreck. Forty-five feet of water was between him and the camera, and the reef in the background, 75 feet away, is clearly in focus.

Bahama negro boys diving.



How the pictures were taken.

Swimming around a dead horse.

Ten thousand feet of film was taken on the expedition; 5,000 feet of this will be selected to show the best results of the many interesting subjects portrayed. Combats between sharks and divers will furnish some of the thrills for the production. The big fellows will be shown fighting for pieces of flesh thrown overboard, tearing at each other in their efforts to get at the food. A naked diver will slip into the affray, and as the shark turns over to attack him, he will plunge a knife into the vital part of the monster. Myriads of striped and odd-shaped tropical fish will be seen darting in and out among beautiful coral reefs and the waving flora of the sea. Queer and unusual plant formations, bending and rippling in the swift currents of the marvelous sea gardens, will be flashed on the screen, and for the first time a clear and life-like view of what the bottom of the sea is actually like will be shown. A surface scene will show the passenger steamers leaving Nassau, and the native black boys sculling and diving from their small boats. Then the scene will shift beneath the surface, and the natives will be seen diving for coins thrown overboard, grasping them, in many instances, before they reach the bottom. The practical diver will also make his first under-water appearance before the world as recorded by the camera man who turned the crank in the operating chamber at the bottom of the tube while the amphibious human went about his work. As he strolls around the wreck of an old blockade runner, hundreds of fish swim about him, and the stream of bubbles issuing from his helmet grow in size as they approach the surface and the pressure is lessened. Many people of note will be shown boarding the "Jules Verne," the odd-shaped operating craft of the expedition which controls the surface end of the big flexible tube. When the visitors go below they witness with delight the marvelous panorama that unfolds itself before their wondering eyes, after which the submarine tube is unfolded, section by section, to demonstrate how easy access to the secrets of the deep is obtained.

These pictures make a vitally interesting page in natural history, and, as submarine work is continued with the Williamson tube, more new and strange sights will be seen. The ever-ready camera man will do his work, and millions will see exactly what he saw and depicted.

What the grass shack of prehistoric man is to the Woolworth Building, or the first dug-out of primitive man is to the gigantic ocean liners of to-day, the present apparatus that we are using—the first Williamson collapsible tube—and the results obtained, will be to the amazing evolution of this submarine device in the future. To photograph the bottom of the sea is, perhaps, the last of the big things to be done on this hoary planet, and undoubtedly it will be done.

Two Giant Worlds

By Frederic Campbell, Sc.D., Former President Department of Astronomy, Brooklyn Institute of Arts and Sciences.

OF all the twenty first-magnitude stars, the inherent glory of Rigel and Canopus is the greatest. Only two are farther than they, while the other sixteen are very much nearer. Antares is 112 light-years distant, its light requiring that number of years to travel to earth; and the next beyond are Rigel and Canopus, 466 light-years distant. Though it takes almost half a millennium to bring us their messages of light, even as perceived from earth Rigel ranks seventh and Canopus second among the entire heavenly host.

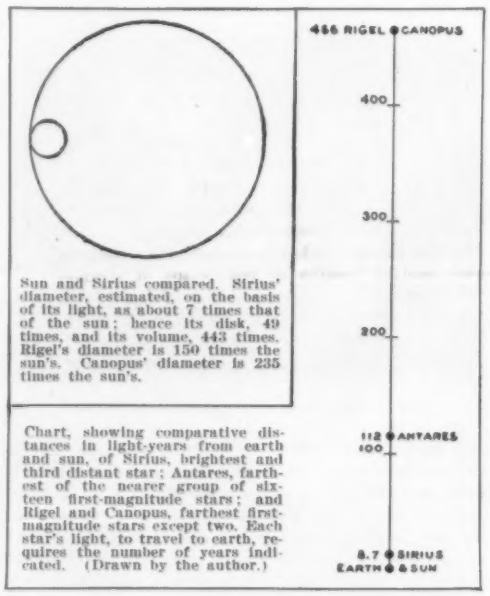
Former estimates gave the light of Rigel as equal to that of 4,000 + suns, and that of Canopus as 10,000 +; but, because the computation of their distance has multiplied it by 2 1/3, considering that the light received from them is unchanged, their inherent light must be multiplied by the square of 2 1/3, or about 5 1/2 times. At the lowest estimate this makes Rigel equal 22,000, and Canopus 55,000 suns.

Brightest of all as seen from earth, Sirius, 8.7 light-years distant, is the third nearest star of the heavens, the second nearest among those of first magnitude, and the nearest among those of the latter seen from our northern regions. It is interesting, therefore, to estimate how bright Rigel and Canopus would appear were they as near as Sirius. Now, their distance is 53.5 times that of Sirius; hence, to bring either of them that much nearer would be to increase its light by multiplying by the square of that figure, or 2,862.25; and as, according to Table A, given below, we now receive from Rigel 18 per cent and from Canopus 52 per cent as much light as from Sirius, we multiply these figures by our 2,862.25, in order to discover that, at Sirius's distance, Rigel would display 515 and Canopus 1,488 times the splendor of Sirius. Such disparity is now utterly unknown among the first-magnitude stars, Sirius, the brightest, being only 15 times as brilliant as Regulus, the faintest. Charmed as mankind has always been with the magnificence of Sirius, what would it be to behold two stars displaying, respectively, 515 and 1,488 times that splendor?

But eleven times as bright as Sirius shines the planet Venus when brightest, next to the moon and sun in effulgence. We have, therefore, only to divide these figures by 11, in order to ascertain that Rigel and Canopus, brought to the proximity of Sirius, would display, respectively, 47 and 135 times the marvelous splendor of Venus. Inasmuch as Venus may often be recognized by daylight, it follows that Rigel and Canopus would be plainly visible even in the glare of the sun.

A step farther. The full moon is 1,727 times as bright as Venus. Consequently, dividing by this number, we ascertain that Rigel and Canopus, brought as near as Sirius, would possess, the former 2.7 per cent and the latter 7.8 per cent, as much light as that of the full moon. The latter figures mean that even the full moon would outshine Canopus only about 15 times, which is nearly the relation of Sirius to Regulus. Any frequent observer of the full moon knows how its light actually dazzles and partially blinds him. Were the new positions of Rigel and Canopus such as would bring the moon into their vicinity, think of the wonder of an occultation, when the moon would draw near, touch, then extinguish the luminary, and it would spring from behind it an hour later! Think also of the infinitely charming spectacle of a close conjunction, with its star and crescent effect!

Inasmuch as Sirius, despite its comparative nearness, is still so distant that the largest telescope cannot sensibly magnify its point of light, we feel the need of bringing Rigel and Canopus yet nearer, and setting them beside the expanded disk of our own sun, in order to obtain a true measure of their size. According to the subjoined table, Sirius possesses 48 times the light of the sun. Provided that its general surface brilliancy is the same as that of the sun, we have only to extract the square root of that figure in order to ascertain that its diameter is about 7 times that of the sun. This does not sound as great as it looks in the accompanying drawing; and it does not look as great as it ought, for the drawing merely shows Sirius's disk 49 times the sun's, whereas its volume would be 7×49 times the sun's volume. The latter is 1¼ million times the volume of the earth. Thus we get some conception of the enormous size of Sirius.



Sun and Sirius compared. Sirius' diameter, estimated, on the basis of its light, as about 7 times that of the sun; hence its disk, 49 times, and its volume, 443 times. Rigel's diameter is 150 times the sun's. Canopus' diameter is 235 times the sun's.

Chart, showing comparative distances in light-years from earth and sun, of Sirius, brightest and third distant star; Antares, farthest of the nearer group of sixteen first-magnitude stars; and Rigel and Canopus, farthest first-magnitude stars except two. Each star's light, to travel to earth, requires the number of years indicated. (Drawn by the author.)

But we are speaking of two giant worlds enormously larger yet. Assuming that their general surface brilliancy is the same as that of the sun, and recalling that Rigel has at least 22,000 and Canopus 55,000 times the light of the sun, the square root of those figures gives us Rigel's diameter 150, and Canopus's 235 times that of the sun. Whereas the sun's diameter, as seen in the sky, measures one half a degree, Canopus's, at the same distance, would measure 117½ degrees of the 180 that reach from horizon to horizon, and its disk would cover 55,225 times the sky area occupied by the sun. Canopus would be nearly eight hours in rising, and, before being fully risen, would already have begun to set; that is, its disk would reach much farther than from the eastern horizon to the zenith. With such a globe brought so near, all life on the earth would instantly perish, seas would be converted into steam, and the very mountains would melt with fervent heat and flow like molten iron. Beside such facts, our corner of the universe seems diminutive, dull, and insignificant.

These two marvelous orbs have been found among a group of twenty to which they belong. Out of the million-million stars known to exist, any twenty, for aught we know, might yield similar specimens. Nothing proves that such worlds are rare. We have not magnified their greatness by bringing them, in the first instance, into unreasonable proximity, but merely to that of their present greatest rival, Sirius, the primate of the order to which they belong, to reach which point, in a mile-a-minute journey, would require 100 million years; and, in the second case, we have not brought them to the proximity of the moon, or even of the nearer planets, but merely to that of the nearest star, our own sun, which itself could be reached, at the same speed, in not less than 177 years.

If the unhurried mind will brood over the facts, as presented in the subjoined table, governed by that inexorable law of our thinking which requires not only a cause, but an adequate cause, for every effect, it cannot fail to observe that, just at the final point, where we are insistently demanding what or who stands back of this tremendous universe, science, having conducted us thus far, gathers up its portfolio and bows itself off the scene.

TABLE OF THREE FIRST-MAGNITUDE STARS.

A. The facts as such.

Rank.	Name.	Magnitude.	Light Received.	Distance in Light-years.	Brilliancy × Sun.
1	Sirius	−1.6	100	8.7	48
7	Rigel	0.3	18	466	22,000 +
2	Canopus	−0.9	52	466	55,000 +

B. If Rigel and Canopus were as near as Sirius.

Rank.	Name.	Distance in Light-years.	Brilliancy × Sirius.	Brilliancy × Venus.	Brilliancy × Full Moon.
3	Sirius	8.7	1	....	....
2	Rigel	8.7	.515	47	.027
1	Canopus	8.7	1,488	135	.078

The Ninth International Congress of Applied Chemistry

FROM a personal letter by the president of this congress, Herr Prof. Dr. Paul Walden, it is stated the following is the order of events to be carried out:

1. The meeting will be held in St. Petersburg, from the 8th to the 14th of August, 1915.

2. Excursions are to be made to Finland, Moscow, Kiew, Baku, in the Caucasus, etc.

3. In addition to the usual addresses, systematic reviews of the work in particular fields (with discussions) are to be given by specialists, on the invitation of the committee of organization, to a greater extent than formerly.

4. Particulars as to receptions, entertainments, etc., will be announced later on.

5. The question of reduced railway fares on the Russian railways is now under consideration by the government.

6. No obstacles will be placed in the way of the journey of Jewish chemists to the congress provided (*a*) that at the frontier, in addition to the revised passport (requisite for every passenger) cards of membership, signed by the president and honorary secretary of the Ninth International Congress, shall have been presented.

7. An announcement in English of the Ninth International Congress will be forwarded during this summer to North America and England.

A Remarkable Test of the "America"

TEN men, weighing 1,542 pounds, flew in the transatlantic hydroaeroplane "America" in a blinding rainstorm and a 35-mile wind, at Hammondsport, on June 29th. This is not only the greatest number of passengers ever carried in a hydroaeroplane, in the world, but ever carried in an aeroplane in this country. The load, including passengers, gasoline and instruments, weighed 1,705 pounds. This is within 500 pounds of what the craft will have to carry for her over-ocean flight.

On July 2nd Glenn H. Curtiss made four flights in the "America" with 2,107 pounds of useful load, more than will be needed in the flight across the Atlantic. The "America" is to have new planing fins extending out from each side over the present bottom. Mr. Curtiss does not anticipate any difficulty in getting a load off the water after the change.

The pontoons that Mr. Curtiss built for Dr. Langley's old aerodrome were detached from the old machine and bolted to the Wanamaker flier under the lower wings as added water planing surfaces, in order to make the trial referred to. Each pontoon will lift 500 pounds. The Langley pontoons were merely put on for testing purposes. The new bottom will be V-shaped, with fins slightly concaved on the lower side.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Waterproofing a Standing Building

To the Editor of the SCIENTIFIC AMERICAN:

The SCIENTIFIC AMERICAN of June 13th refers to a remedy for dampness in buildings "devised by a German engineer," and consisting in sawing longitudinally and transversely the walls and progressively inserting impermeable plates. In 1876 I did this to a building, still standing, at 937 Rhode Island Avenue, this city. The "machine" consisted of a discarded sawmill saw, propelled by two darkies, one inside and the other outside the building. As the cutting progressed, I dipped slate slabs in cement and drove into the cut with a mallet. It fully remedied the trouble.

Washington, D. C. CHARLES E. FOSTER.

New Zealand's Big Things

To the Editor of the SCIENTIFIC AMERICAN:

There is a statement in "Extra Tropical Plants," by Baron von Mueller, Victoria, Australia, that *Eucalyptus amygdalina* was measured up to 471 feet from the ground by Mr. G. W. Robinson, surveyor at Mt. Baw Baw, Victoria. There is a photograph of a redwood in the museum here; height given, under 440 feet; diameter, 33 feet. The Encyclopædia Britannica and Chambers both give the same relative proportions, the diameter being greater in the redwood. In the same museum we have the moa bird, at 14 feet height, and the blue whale, at a length of 87 feet, caught at Okarito, West Coast, the tree, moa, and whale being world records.

Christchurch, New Zealand. FREDERICK ELSOM.

Testing Speed of Yachts by Log

To the Editor of the SCIENTIFIC AMERICAN:

In the eighties I belonged to an amateur crew that sailed in the fastest catboat in New England waters. We took some twenty prizes in one season, mostly first, and a few second prizes. I often raced against Mr. Adams. Now, I claim that the best professional or amateur yachtsman cannot determine the exact speed of a boat without the use of a log. Some models will foot fast when pointing up well into the wind; others will have to have more sheet to foot well.

Now wouldn't it be a good plan for the three boats to use a log to know when they are sailing the fastest with the different trim of the sails? I have never heard of a log being used; but I think where the boats are so nearly matched it would be an excellent plan, and the *only* way to determine their exact speed. I am rather diffident about making suggestions to such able skippers as are handling these yachts; but my experience in racing craft and interest in the cup defense causes me to write this letter. FRED. BRADLEE ABBOT.

Sharon, Mass.

Confusion in Wireless Messages

To the Editor of the SCIENTIFIC AMERICAN:

The comments made in your correspondence column of June 6th, 1914, do not alter the conclusions expressed in my communication of May 16th, 1914. If various inefficient conditions, such as improper spacing, are assumed to be tolerated, there are, of course, many combinations of code letters which may be mistaken, for after all is said, the code is merely a combination of dots, dashes, and time intervals made intelligible solely by a predetermined and proper sequence.

I must take exception to the remarks of the last paragraph of the last criticism; even if all possible tones were in use (which is, in my opinion, not the case, certainly not with the apparatus I employ) it would still be a simple matter to designate a combination covering a sufficient error due to inaccuracies in imperfect apparatus, by international regulation, just as certain wavelengths have already been assigned for particular purposes. The method which I have mentioned is really very simple and contemplates no "endless undertaking," because repeated adjustments are not necessary nor desirable. Evidently, the latter statement of the column of June 6th, 1914, assumes that no modification or improvement on the older apparatus now in use entered into the question, which, as I have indicated, is not the case.

Minneapolis, Minn. PHILIP E. EDELMAN.

Technical Writing by Untechnical Men

To the Editor of the SCIENTIFIC AMERICAN:

In the May issue of a high-class, conservative monthly there appeared an article, called "Skyscraper." It struck my risibilities to such an extent that I have attempted to put in writing the impression which it gave me. I inclose the result.

TECHNICAL WRITINGS BY UNTECHNICAL MEN.

"The old brick building had vanished . . . in a *cloud* of broken brick (cloud of brick)" and plaster. Already the muddy floor was dotted with the toadstool *tents* of the excavators. . . . Far down in the *stifling* air of the caisson" (stifled with oxygen), "the concrete roots were being planted, *tied with cement* and steel to the very core of the world."

"The foundations were finished and the first thin columns" (weighing possibly one ton per foot) "stretched upward. In ordered plan, the cross beams *fell* into their places, and the great lattice of the substructure" (that is to say, superstructure) "shaped itself."

"On the topmost story, the derricks crouched like giant spiders, thin legs braced against post" (or was it column?) "and I-beam. Untiring, hour after hour, the derricks lifted *bales* of steel, and as each story was *bolted* down" (by the pneumatic riveters) "the derricks lifted themselves heavily to the new level. . . ."

"Like beetles, the steel workers clambered surefooted over the empty frame. Like flies they caught the slim-spun threads of the derricks and swung up to some inaccessible" (although they did get there) "height."

"Day faded in fog and darkness. Like beacon fires the forges of the workers glowed intermittently" (showing conclusively that scab-labor was being employed).

"I am thinking also of the other workers: of men who measured this tall tower on their *slide rules*" (and worked out the formula for long columns on their tape measures). "Engineers who foresaw each bolt and fitted so perfectly mass on mass" (without any previous experience and) "with only imagination and their books of figures to guide them, . . . workers in the steel mills of the distant city who molded" (or perhaps rolled) "each beam and pillar to go together like a watch—theirs is the silent forgotten labor!"

Let us hope that these *nocturnes* by untechnical men will be as soon forgotten!

Does the reading public really demand these inabstinent writings? We had thought not, so long as they were confined to the Sunday Supplement; but it does little good, apparently, to appeal from Philip drunk to Philip sober when an article such as that from which we have just quoted, appears in one of the most conservative of monthlies.

Surely this is an era of adjectives, and extravagant style. Let us quote once more: "Angry clatter—shattering reverberation—gaunt frame—casting their threads of steel softly—the building surged higher—slim-spun threads—blinked red—mystic blue prints—trail of jeweled fire—automobile lights streaked the gleaming blackness—panting breaths of red—wisps of steam—smear of smoke."

Is it any wonder that, as the author of these words stood on the dome clutching the flag-pole, the steeplejack, who stood beside him, said, "Don't break off that pole, I've got to climb it"?

CHARLES S. RINDSFOOS,
Secretary-Treasurer the Foundation Company.
New York.

Wireless and Sound Prevention of Collision in Fog

To the Editor of the SCIENTIFIC AMERICAN:

The many recent collisions at sea in a fog between steamship have started a great many inquiries, suggestions, and criticisms of the present rules and regulations of navigation. In all this controversy, however, there is but one obvious fact, namely, few ships, if any, are absolutely unsinkable. There are a few ocean liners of the latest double shell construction which, should they be injured as the "Empress of Ireland" was, might remain afloat for a few hours. But these few modern boats are such a small percentage of the entire shipping world that they form a negligible quantity of safe ships. Admitting for a moment that these double-sided latest steamers are absolutely safe, it would be impossible to reconstruct all other ships to make them also unsinkable. Therefore, in order to avoid repetitions of the latest disasters at sea in a fog, there seems to be but one remedy: to bring ships to a standstill until the fog lifts and then proceed on their courses. As this would not be practicable for obvious reasons, the only other solution to prevent collisions would be to definitely establish the distance separating two ships and their respective courses, for if they knew the exact distance they were apart and knew the direction each one was proceeding in, it would be impossible for them to collide. Therefore, the following method of establishing the distance and direction of navigation between two ships seems to me a simple solution of the problem.

In the first place, it is, of course, necessary to have every ship equipped with wireless telegraphy, and as almost every liner to-day has this installation, it would be a simple and wise move to make it compulsory by law.

Now, suppose two steamers are at sea in a heavy fog and one half mile apart. Ship number one signals with her fog horn, and at the same instant a wireless signal is sent out. Wireless being practically instantaneous compared to sound, which travels at 1,000 feet per second, ship number two receives the wireless message first, and then, after a lapse of about 2½ seconds, the horn signal is heard. The difference in time between the receipt of these two different signals will immediately show the second boat how far away steamer number one is, and at the same time the direction of travel could also be noted by exchanging wireless messages. If the two vessels, when say a quarter of a mile apart, were required by law to come to a dead stop, how could there ever be a collision so long as there was no headway?

New York. CARL A. BROESEL.

[A similar proposal was made by another reader of the SCIENTIFIC AMERICAN, whose letter we have published.—EDITOR.]

Night Warnings for Steamship Passengers

To the Editor of the SCIENTIFIC AMERICAN:

I have long thought of a possible way of arranging a practical means whereby passengers could be warned at night when the greater majority are in their cabins asleep.

Having traveled a good deal on board ship as a passenger, it has frequently been impressed on my mind, that should any accident happen during those hours, we (the passengers) would have a poor chance of being saved, or in some cases of even knowing anything untoward was happening, as no doubt occurred in this latest disaster. The shock, as a general rule, is "very slight"—or "is scarcely felt," according to evidence given by survivors.

If the practical use of my idea will put traveling on board ship on a safer basis than formerly, so much will have been accomplished. This would consist of an electric device, such as is in use in private homes; simple in action and dependable, and wherever the individual may be, the warning will reach them through it, whether under the passenger list heading or belonging to the ship's company, and they will have as much warning as the officer on duty himself who is directing operations at the time of any accident.

This will be accomplished by pressing a single button on the bridge. The indication board showing the numbers of the cabins, positions, etc., could be placed where most convenient on the bridge, and upon the officer pressing it, a corresponding "red light" and "loud bell buzzer" (or bell buzzer only) would be instantly set in motion in every cabin, cook's galley, storeroom, engineer's quarters, engine-room, and so on. Firemen in the stokehold, who are in very great danger indeed, would thus receive just as much warning as any first-class passenger. Then, by the individual pressing a button (wherever that individual might be), her or his corresponding red light would go out or show clear on the indicating board on the bridge as well as stopping buzzer in the cabin. The indication board, as before stated, would necessarily be placed where the officer of the watch could see it directly. Wherever a button was pressed anywhere on the ship, a corresponding red light would go out, or turn clear at the officer's end, thus indicating in the quickest possible way who had vacated, and who were still between decks.

It also could be installed for the chief steward's use (or whoever might be deputed to such duty), and placed where convenient for such an emergency, when he could direct his men to those cabins not yet heard from. The officer and the steward would thus be looking at different boards, indicating clearly and simultaneously, identical in every particular.

Also each individual, on getting up and stopping his own buzzer but hearing one still working on either side of him, could cause additional warning to his fellow-traveler, by hammering on the partition with his fists (or anything handy).

During any voyage "false alarms" could be inaugurated, to see that every individual was familiar with the use of the "safety device," and a small fine imposed on everyone failing to answer "the call," the proceeds to be placed in the Sailors' Institute Fund, or for a similar good cause.

This lamentable wreck of the "Empress of Ireland" (according to paper reports) "might have been prevented." Capt. Henry George Kendall, in relating his story of the disaster, is reported to have said that "from the time when he saw his ship was in imminent danger to the time it sank, occupied about nineteen minutes." This would certainly have been ample time for every passenger to have reached the deck at least, and a possibility of ultimate rescue when they were thrown into the water, if the aforesaid "safety device" had been in use.

If a system such as I have described has been spoken of heretofore, I have not heard or read of it. But if someone has done so, why has it not been adopted? Actual cash should hardly figure where human lives are at stake, and, anyway, the wiring for lighting purposes is in the cabin, and could possibly be utilized in conjunction with "the call." G. M. RUSSELL.

Seattle, Wash.

Germany is said to have an over-supply of foresters; so that well-educated men have hard work to secure even inferior positions.

It was not necessary to rectify unsanitary conditions about homes that had children attending the school.

Eliminating a City's Filth and Flies

Cleveland Battles Against the House-Fly

By Jean Dawson, Ph.D.

A common method of scattering garbage. In fighting flies this is but one of many conditions encountered.

FOR the past two years a campaign has been waged to put Cleveland on the map as a flyless city. The work has moved forward with vigor. Human brain and effort have been pitted, not against the fly's wisdom and cunning, but against its marvelous powers of reproduction, which man must calculate by geometrical progression. The Cleveland public have been stimulated to do battle against the fly from March to January, with the result that they have held the fly in check to a marked degree. The methods of attack have been three-fold, i. e., killing the over-wintering fly before it has a chance to breed; trapping and poisoning those that have escaped and are breeding in the city; ridding the city of the organic filth in which flies can breed.

In the previous campaign, the city fought flies by the first two methods alone. But we have felt that reducing the number of flies after they have hatched is much like a person sopping up water from an open faucet, in itself a necessary step, but not a permanent measure. The second year of our campaign we determined to go deeper and strike at the roots of the fly nuisance, and it was with the hope of closing the faucet by cleaning away the fly's breeding places, and thus effectually ridding the city forever of the greatest carrier of disease known to medical science, that the work of the campaign of 1913 was continued into midwinter, when frost and snow made the public forget the pests that infect the summer months.

Increased Confidence.

With a year's experience to draw upon, we started the campaign, with added hope and not a little assurance, for we had gained unmistakable ground. Thanks to a number of forces at work, we have changed a scoffing, skeptical public, who thought that you might as well try to stop the wind from blowing as to try to rid a community of flies, into one that believes at least that there is something in it. Perhaps a year's hard work may seem a high price to pay for a grain of faith. It should be remembered, however, that we are fighting the traditions and teachings of centuries. From the beginning we have been imbued with the belief in the harmlessness of the fly. Who cannot remember the poems and songs written to eulogize the innocence of this insect? Nor is this harmful teaching at an end. With a world-wide agitation against the fly, we still find a large book company putting a revised second reader into our schools, with the poem, "Baby Bye." This, too, in the face of the fact that scientists are telling us that the fly is more deadly than all the lions, tigers, and snakes in the world. Think of a child, at its most impressionable age, learning the following stanzas:

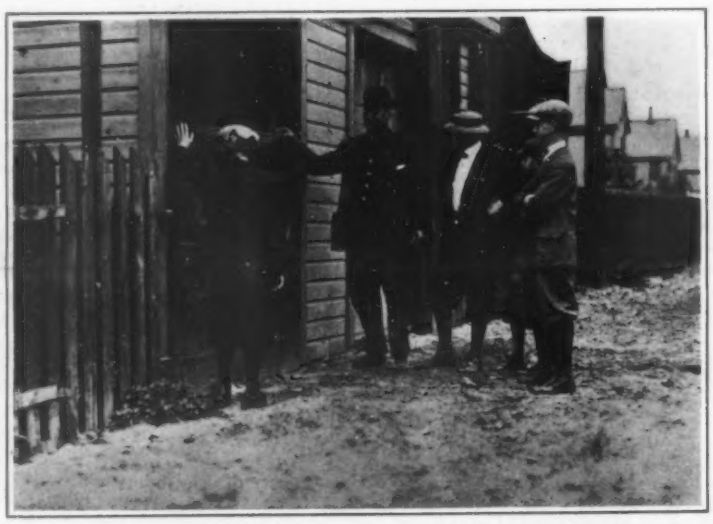
"He can eat bread and meat,
See his mouth between his feet!
On his back is a sack
Like a peddler's pack.
Does the baby understand?
Then the fly shall kiss her hand:
Put a crumb on her thumb,
Maybe he will come.

Round and round on the ground,
On the ceiling he is found;
Catch him? No. Let him go.
Never hurt him so!
Now you see his wings of silk
Drabbled in the baby's milk,
Fie! oh, fie! foolish fly!
How will you get dry?"

The fly does its deadly work of carrying disease germs to food so stealthily that man has been wholly unsuspecting. Even when he does learn the truth, it is difficult to believe the treachery of an animal that has lived for centuries in such intimate relationship with mankind. Had man been less trusting, the repeated accounts of the association of flies with plagues and pestilence recorded in the Bible might have caused him to learn the truth long before he did.

Knowledge and belief must precede action. From the first the idea uppermost in our minds has been to unite the efforts of the whole community to do team work, as it were, in destroying the fly. It has been, therefore, with a good deal of pleasure that we heard confessions on all sides that the reduction of the flies in the past summer had led many people to change their minds on the ultimate elimination of flies from the city. The conversion of business men, especially those dealing in food products, was gratifying because the burden of the work naturally falls on the men whose merchandise is attractive to flies. One man, who has spent nearly a half century in the Cleveland markets, confessed that it gave him a genuine shock when he first heard of our intentions to rid the city of flies. "I thought the idea was wild enough to have originated in the Newburgh asylum. I couldn't imagine a summer without flies. But I want to apologize.

"When I saw how well the traps worked and how they reduced the number of flies in our market, I went to work in earnest, and now there is no cleaner market in the city." It was true. This same man added: "I was brought up in the country, and I could not believe that flies breed in stable refuse, until I kept some manure in a closed box for a few days and actually saw the flies hatching and crawling up with their wings so wet that it was some time before they could fly. I am satisfied now," he added, "and you need never worry about any flies breeding about our stables."



Junior sanitary policemen discussing with a neighboring landlord ways and means of removing filth in which flies are breeding.

Heading Them Off

The previous year the killing of the over-wintering or mother fly had been so successful in noticeably reducing the fly population that it was unanimously agreed to repeat the winter campaign. The distribution of 200,000 swatters among the schools of the city, together with the offer of ten cents a hundred for all flies brought to the Anti-fly Headquarters in the city hall, served to put a bounty on the head of every fly that ventured from its hiding place. Boys spent their leisure hours in the most likely places for flies, while little girls carried their swatters back and forth to school, so as to be ready for an unwary fly that might cross their path. The presence of a fly in a school-room caused so much excitement that work had to be suspended until the fly was dispatched. To avoid undue disturbance, one teacher made the rule that the first child who saw a fly should leave his seat and get the swatter without attracting unnecessary attention.

In all about $500 was spent, representing a catch of fifty thousand mother flies which, had they lived to lay eggs, would have filled the city with a plague of insects. Of the fifty thousand flies killed in the early spring, the great majority were blue and green bottles, a much larger proportion than the previous year. These flies seem to breed earlier than the house-fly. At any rate, it was not an uncommon thing to see a rose-bush or a vine covered with blue or green bottle-flies, that had just hatched in the fertilizer around the roots of these plants. Upon investigation the fertilizer used was found to be dried blood, a product of our local packing houses.

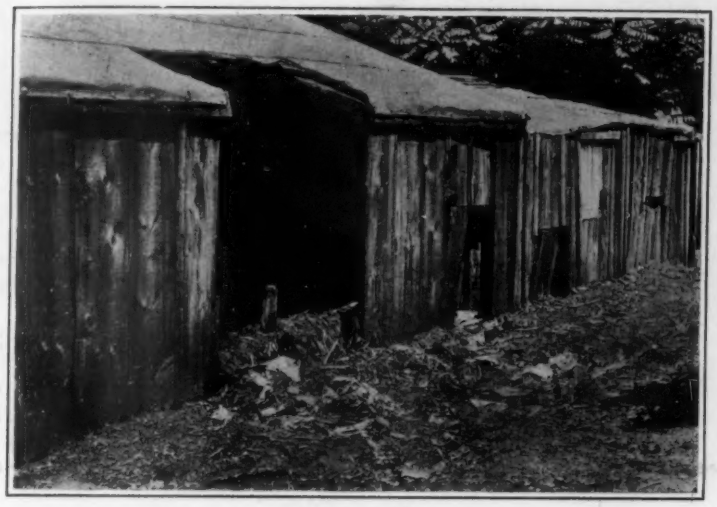
Creating Public Sentiment

The business of swatting flies was not confined to the school world alone. It became a common topic of conversation in all parts of the city. The interest of the public was created largely by the activity of the newspapers. Through news items, human-interest stories, poems, songs, cartoons, and every device and art known to the newspaper world, the daily papers of the city kept the whole community united in an effort to rid itself of a common enemy. Forgetting business rivalry and their differences in political views, the public-spirited newspaper men of Cleveland did a constructive piece of work for the future good of the community, that may well be emulated by every city in America or, for that matter, the entire world.

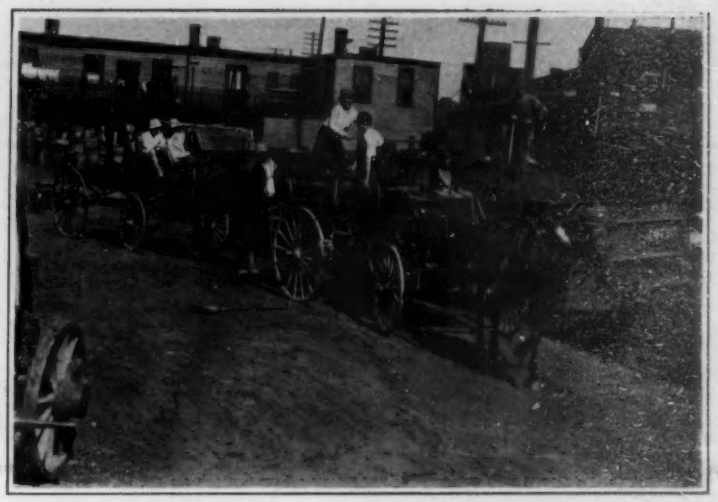
The agitation against the house-fly is making the public very sensitive to the presence of flies. The owner of a number of fine delicatessen stores in the city remarked that he never had liked flies, but that they had not bothered him as they do now. "Why, the sight of a fly crawling on food fairly nauseates me." This same feeling is reflected in the child who wrote her teacher that she had to throw away her biscuit because a fly lighted on it, while she was eating. "I tell you the people of Cleveland don't appreciate the reduction of flies until they have been away from the city for awhile," a young lawyer remarked last fall. "Business called me to the town of X for a month, and do you know that I was pursued, eaten alive fairly with flies. I am not through down there, but I had to leave for a few days because I got so that I couldn't eat. The queer part of it is

Flies breeding about neglected stable, back of Euclid Avenue store.

Girls, working in pairs, noted the unsanitary conditions of stables.



Fly-breeding places in the heart of the city.



Shipping stable refuse before flies can develop.

that the people did not seem to mind flies, I really don't believe they saw them."

It is a fact that a few flies seem many to the Cleveland people, but a sensitive public is one of the best assets in a fight to eliminate this insect. The day that we can produce a public with sufficient imagination to picture the flight of a fly, as it emerges from the filth from which it breeds to tubercular sputum in street and alley, thence to contaminate the food in restaurant, bake-shop, or grocery-store with its germ-laden feet, that day, and no sooner, will the fly-infested shop close its doors from lack of patronage.

Taking the Fly Census

About every two weeks during the summer young women were sent to the lunch-rooms, and to stores retailing food to gain an idea of the effort that was being put forth to keep the people's food from contamination. The young women estimated the number of flies in each place of business and learned the methods, if any, that were being used to fight the flies. To facilitate the work a printed blank was used:

Anti-fly Campaign.

Date .....
Street ..... No. .....
Kind of Store.....Restaurant.....
No. flies seen in 3 minutes' time.....
Remarks .....
Name of Inspector .....

For instance, August 13th, 1,138 groceries, meat markets, candy shops, restaurants, and miscellaneous food stores were inspected. Of these, 131 were free from flies, 487 had less than ten flies, 514 had more than ten, and less than fifty, and 6 had many. These results are due largely to the general reduction of flies in the city and not to the employment of the more modern methods of catching flies in traps. Indeed, few merchants were employing methods other than their fathers had employed before them. This is remarkable in that a few minutes spent in baiting a trap, placed on the outside of a store, would save hours of a man's time, and then, too, get the flies before they could enter and contaminate the food.

Women Responsible for Flies in Stores

No census of the flyless homes was taken. It is safe to say, however, that had there been, the percentage of flyless homes would have far outnumbered the proportion of flyless stores. Perhaps this is due to woman's interest not extending beyond her home, or to diffidence on her part, which causes her to buy food in fly-infested stores with only inward protests.

Realizing that the sanitary conditions of the retail grocery store, meat market, bake shop, and milk depot is in the hands of the woman, who supplies the city's table, we printed the following card, which we hope will enable her to express her opinion to these merchants without embarrassment:

Flies carry unnamable filth to food. I counted ..... flies in your place of business.

A CUSTOMER.

Date .....

Several of these cards inclosed with orders from a number of good customers would, we believe, cause a speedy elimination of flies from stores and fly-specks from the store windows. Men understand a customer's power to regulate conditions much better than women; hence it is not surprising to learn that the lunch-rooms that were freest from flies in the city were those that were frequented by business men. This result is brought about largely by the business man himself.

Before the breeding season began ten cents a hundred was paid for all flies brought to the anti-fly headquarters.

Protesting against flies in a down-town restaurant one day, a business man relates that the owner claimed that he could not help having a few flies. "I told him that it was up to him to find a way to get rid of his few, if he cared to retain the patronage of the people from our office." This same business man ventured the opinion that no matter what happened to the anti-fly movement, the people of Cleveland would never tolerate the flies in the lunch-rooms, restaurants, and hotels that they had in the past.

Young women from college and normal school rallied to the call and were soon taking lessons in the practical biology of the fly, within a stone's throw of the markets.

Children Aid in Cleaning the City

Before the Winter campaign was well over we began to enlist the interest of the children in other phases of the work of fighting flies. The pamphlet, "Questions About the Housefly," revised to include the results of the recent researches on the stable-fly was distributed to the school children, together with the following letter, which makes a direct appeal to each child to do seven specific things, to aid the city in its fight against the fly:

The Anti-fly Campaign.

March 28th, 1913.

Dear Boys and Girls of Cleveland:

Do you know that much of the sickness and death in our city is unnecessary and that we can do away with it if we all work together to get rid of filth and flies?

Will you do your share and try to get others to help you to make Cleveland the first flyless city in America?

1. Will you learn about flies from a little book which will be given you? Will you loan this little book to others, who do not know when flies breed and how they carry disease?

2. Will you get rid of every fly as fast as it comes from its place of hiding, remembering that to kill one fly in the spring before it lays its eggs is equal to killing thousands in August and September?

3. Will you tell everybody to keep flies away from sick people, because the flies carry germs from the sick to the well?

4. Will you clean up your yard and put all dirt and rubbish in baskets, cans or boxes, so that Mr. Hanna can carry it away?

5. Will you see that the garbage is covered, so that the flies will not come near your yard to feed or breed?

6. If you know where there is filth and dirt will you write a card to Mr. Hanna at the city hall, or will you tell the Junior Sanitary Police of your school to see that it is cleaned away?

7. Will you remember that flies carry filth and disease germs on their feet to food and that clean food is just as cheap and less dangerous than food that is fly-specked? Will you tell your mother where you see flies crawling over food, so that she will not buy it? Very sincerely yours,

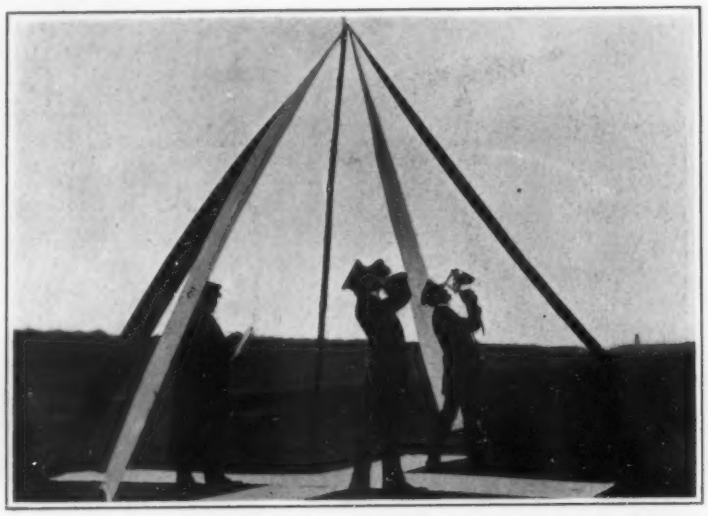
JEAN DAWSON, *Director.*

A letter was also sent to the principals of the grammar schools instructing them how to organize children in the upper grades to work for the improvement of the sanitary condition of their school district. School authorities did not urge the grammar schools to help in the work of ridding the city of filth and flies; neither did they hinder them—each school was left to act as time or inclination might prompt. Wherever principals and teachers were in sympathy with the work, the boys of the upper grades were organized into Junior Sanitary Police and the girls into Sanitary Aides. A group of the finest boys and girls was selected to lead the school; the boys to ferret out the unsanitary conditions in yards, alleys and vacant lots, and the girls to promote an absence of filth and flies in all stores where food was kept.

After the election of officers, each boy and each girl was given a portion of the school district to investigate, and later to report upon to his superior officer. Before reporting a case, however, he was to make every effort in a polite way, to get the work done.

(*Concluded on page 34.*)

The operator sights the lamp, and when he has found his man, presses a button, thus causing the light in the mirror to flash.



One man is watching the light signals made by an aviator and another is preparing to answer.

Signaling With Electric Light in the Daytime

By Our Berlin Correspondent

THE light radiation from electric incandescent lamps, at extremely high temperatures, can be increased without any corresponding increase in the energy consumption. A proper utilization of this fact for lighting purposes is unfortunately impossible, the life of lamps decreasing rapidly in the process. But if the light be flashed, as in signaling, the phenomenon becomes of practical importance. A life of even a few hours is sufficient to give out thousands of signs. On this principle is based Prof. Donath's signal mirror.

The whole apparatus, inclusive of the battery, weighs only 11 pounds, and thus constitutes no appreciable surplus load for the soldier or an aeroplane. It comprises the following main parts: 1, a mirror (reflector); 2, an incandescent lamp; 3, a lamp adjustment; 4, a sighting tube; 5, a handle, a switch, and leads; 6, an accumulator battery.

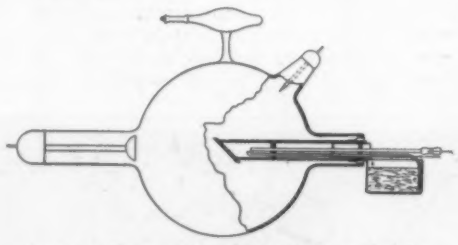
The minute incandescent lamp, provided with a special filament arrangement, is fitted into a small parabolic mirror along the axis of which it is arranged to be shifted so that the position in which a parallel beam of rays is sent out can be readily found. The operator points the sighting tube above the mirror toward the point which is to receive his signals, after which he makes contact by pressing the button of the mirror handle. The signals used in this connection may be those of the Morse code or conventional signs.

The possibility of giving out light signals in bright sunshine with such an immaterial energy consumption, of course, strikes the minds of those unacquainted with the apparatus as a paradox. Nevertheless, signals can be transmitted by day, under normal conditions, to about four and one quarter miles. A short flash corresponds to the dot, and a longer emission to the dash of the Morse alphabet, the duration of current closures being about two and six seconds, respectively; between each two signs there are intervals of about four seconds.

Gamma Rays Produced by Means of an X-ray Tube

LET us briefly refresh our memory with regard to the nature of the several radiations given out by radium, and commonly known as alpha, beta and gamma rays. The alpha rays have been shown to be atoms of helium carrying an electric charge, and shot out from radioactive materials in the course of their disintegration. The beta rays are "electrons," that is to say, elementary charges of negative electricity, emitted with a velocity approaching that of light. Both alpha and beta rays are thus "corpuscular" in character, there is actual transfer of a moving particle over the path of the radiation. Gamma rays, on the other hand, are not corpuscular, but undulatory, that is to say, they are propagated like waves. When a stone is dropped in a pond it starts a series of waves traveling outward. The individual particles of water merely oscillate up and down—there is no transfer of matter along the direction of propagation of the wave. Gamma rays, then, are such wave disturbances, and in point of fact they are of the same nature as X-rays, which in their turn are of the same nature as light, namely, electromagnetic waves carried by the ether. What distinguishes X-rays from light rays is the distance from crest to crest of each wave, which is much shorter in X-rays than in visible light radiation. Gamma rays, in their turn are of still shorter wave length than X-rays as ordinarily produced. All these relations are clearly presented in tabular form in a note which appeared in the SCIENTIFIC AMERICAN SUPPLEMENT for September 18th, 1913, p. 175.

The reader may ask: How is it possible to distinguish between such radiations of different wave-length? Without going into technical detail we may say briefly that X-rays of different wave-length are characterized



Arnheim X-ray tube with cathode cooled by atomized water.

by their varying "penetrating power" or "hardness," that is to say by the impression which they make upon a photographic plate or fluorescent screen after traversing various thicknesses of a medium which absorbs

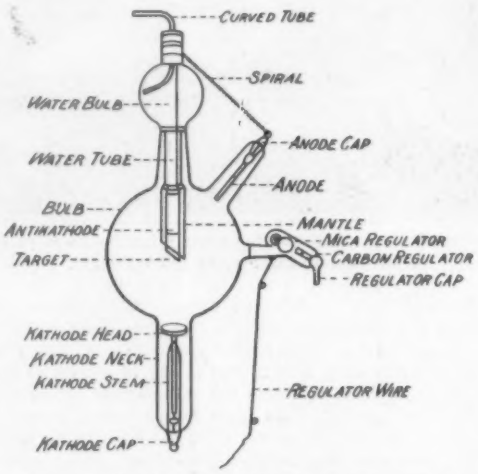
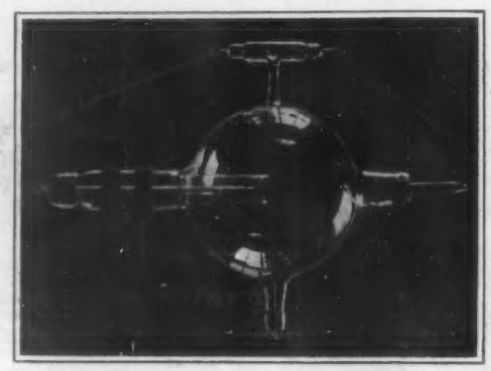


Diagram showing the terms in common use to denote the different parts of the instrument.

X-rays, such as for example aluminium. The shorter the wave-length, the harder the ray.

Now in an article in last week's issue, on the treatment of disease with X-rays, it was shown that the hardest rays obtainable are in several respects the best adapted for the physician's needs. In this respect radium, with its gamma rays, seemed to offer a certain advantage over the use of X-rays as ordinarily produced. Until recently the hardest X-rays obtainable from a vacuum bulb had only about one twentieth of the penetrating power of gamma rays. Friedrich Dessauer of Frankfort-on-the-Main, has recently so perfected the X-ray tube that he can produce rays practically identical with gamma rays—the ratio of the hardness of the two being as 1:1.2. This result is obtained by employing a special and highly efficient device for cooling the anticathode, and by other precautions to be mentioned presently. For the benefit of those readers who are not familiar with the construction and operation of X-ray tubes it may here be explained that the electric current passing through an X-ray tube causes a stream of charged particles (not unlike alpha rays) to pass from a cathode to an anticathode. They strike the latter like a target, at a high velocity, and their impact causes X-rays to spread out from the target. This action has very aptly been likened to the effect of throwing pebbles against a barn door, from which sound waves are thus caused to be emitted.



Special form of X-ray tube for internal treatment.

The rays are filtered as they issue, so that exclusively hard rays come into action.

The anticathode, in this bombarding process, becomes intensely hot, and various methods of cooling it have been introduced, since it is found that such cooling is essential for the production of hard rays. An obvious method which has been employed is to make the anticathode hollow and to circulate water in it. Dr. Arnheim, working in the institution of which Friedrich Dessauer is director, invented a greatly improved cooler, in which advantage is taken of the high latent heat of evaporation of water. A fine spray of water is conducted into the anticathode, where it rapidly evaporates. When we remember that in evaporating, one pound of water can lower no less than 536 pounds of water through 1 deg. Cent. (1.8 deg. Fahr.) we see how much more efficient this method is than mere cooling by circulation.

Other important factors in Dessauer's improved X-ray tube are the special method of introducing the current, the current density at the cathode, and other technical details.

A great advantage of the X-ray tube over radium as a source of gamma rays is that a powerful stream can be obtained at a cost of installation in incomparably less than that of the corresponding amount of radium which would be required to furnish the same stream of rays.

The Sperry Gyroscopic Stabilizer in France

THE stabilizer invented by Elmer A. Sperry of New York, which was used on a Curtiss aeroplane in a safety contest on June 18th, was awarded the first prize of $10,000 offered by the French War Department. The second prize was awarded to the Paul Schmitt Aeroplane Company.

The contest on June 18th was a two hours' test on the Seine between Bezons and Argenteuil. Lawrence D. Sperry, son of the inventor, piloted the winning machine and had a mechanician to assist him. A large crowd watched the wonderful exhibition given by young Sperry.

Lawrence Sperry and his mechanician performed several wonderful feats while in the air. Young Sperry stood up in the machine with his arms folded, and Cachin, the mechanician, climbed to the end of the lower plane and back. Nevertheless, the balance of the machine was not destroyed. The Sperry stabilizer has been fully described and illustrated in the SCIENTIFIC AMERICAN. A description of the Paul Schmitt biplane will soon appear.

Portable "Water Cycle"

PICTURED in the accompanying engraving is a catamaran fitted with a propeller, and mechanism for driving the propeller by hand. The photograph shows the daughter of the inventor out for a spin on the machine. The two pontoons are made of rubber and waterproof duck, and may be inflated with a common bicycle pump. They are connected by a light metal framework, which carries the seat and supports the driving mechanism. The full weight of the machine is twenty-eight pounds, and when collapsed it folds into a small parcel that can readily be carried about. By means of step-up gearing between the hand cranks and the propeller the latter may be driven at high speed. The boat is steered with the seat, which is connected with the rudder.

A hand-propelled catamaran.

Telephone extension of mother's ear.

A Monster Fog Horn

ALL the up-to-date light stations possess fog signals for warning the mariner of the presence of rocks and other dangers in foggy weather. The larger ones are so powerful that their blasts can be heard 25 to 30 miles out at sea. Most of them are worked by compressed air, a gas engine of perhaps 20 to 25 horse-power being brought into requisition for this purpose. The siren is blown periodically, every 70, 80, or 90 seconds or so, the actual blast lasting perhaps about 2 to 3 seconds. It means that while the siren is running, in the case of the larger apparatus, something like 500 horse-power is being expended in the production of sound! We get an idea of the tremendous size of the modern fog signaling apparatus by comparing the man in the photograph with a lighthouse fog trumpet through which the sound is directed over the waters.

It utters fog warnings that can be heard thirty miles away.

Transporting Steel Boats from Cincinnati to Chicago

FIVE steel-hulled gasoline-motored boats that plied the waters of the Miami and Erie Canal, were purchased recently for service on the Great Chicago Drainage Canal. To get them to Chicago was a big task as the Miami and Erie Canal, before emptying into the Ohio River at Cincinnati, terminates in an underground stream on the outskirts of the city, and the transports were twenty squares away from the river. This necessitated their being taken from the canal and transported overland through the heart of Cincinnati's business district.

To get boats on trucks, a huge derrick was built over the canal and the transports were lifted from the water by means of pulleys and steel cables, then shifted over upon the trucks waiting on the canal banks. As each of these transports weighs 20 tons and is 150 feet long and 15 feet wide, it required two days to place each of them upon the trucks and another day to haul it the twenty squares to the river. The five boats were then made seaworthy preparatory to beginning their 1,200-mile voyage down the Ohio, into the Mississippi, up the Mississippi and Illinois rivers to the Great Chicago Drainage Canal port.

How the steel boats were lifted from the canal and placed upon trucks.

Building Ceremonial in China

EXCEPT in treaty ports where the modern influence has made itself felt in such ways as street cars, modern buildings, etc., Chinese methods are much the same now as they were a thousand years ago. It has long been a ceremonial custom to pound the earth preparatory to erecting a new building. A ring of coolies, or fokies, each at the end of a rope which terminates in a large stone in the center, sway inward and outward, allowing the stone to rise and fall upon the ground. The work is accompanied by a weird singsong, and the whole procedure is considered as being propitious to the lives of those who will inhabit the structure which is to be built.

Pounding the earth for a Chinese building foundation.

The Telephone Nursemaid

PROBABLY the youngest child to habitually use a telephone is to be found at the present time in Guernsey, where a four months' old baby sleeps every fine day in the open air with a telephone transmitter at his side by which he calls his mother on awakening. Thus a problem is solved which has troubled many a busy mother who, having no nursemaid, cannot spare time to be constantly outside looking after baby and yet is not willing to deprive her child of the benefits gained by putting it to sleep in the open air.

Many a child, indeed, who strenuously refuses to sleep in the house quickly goes off to slumber when taken outside, thus showing a wisdom beyond its years. The baby here referred to belongs to the engineer in charge at Platte Fougère Lighthouse Station, who in order to allow his boy to benefit by the breezes blowing in from the Atlantic, contrived this method.

In the baby carriage is a cigar box containing the telephone transmitter and a small clock. Wires running up to the house, twenty yards away, enable the mother in the intervals of her work to listen for baby's cry. When working at the table and during meals it is easy to listen continuously.

The clock, although its use is not at first apparent, forms an essential part of the device, for the sound of its ticking provides the necessary proof that the telephone is transmitting sounds correctly. This method of employing the telephone as nursemaid has proved completely successful and is in daily use, while a rain alarm has also been evolved to give warning by causing an electric bell to ring should a shower come on.

Freaks in Baseball

FREAK plays make baseball humorous if not interesting. Some of these plays are said to be the result of quick thinking, but as a matter of fact, most of them are simply luck.

Curious things happen. A ball fell into a tin can, and it being impossible to get it out in time, can and all were thrown to the baseman. Another ball hit the end of a nail driven through the opposite side of a fence and could not be got down until all the runners scored.

A swift hit glances off the pitcher's hand, is snapped up by an infielder and thrown to first, putting the man out.

Red-hot liners or grounders sometimes hit the first or third base bag and glance away for singles or even two-baggers.

The shortest two-bagger known was when the ball grazed the bat, shot up a few feet, and fell in front of the plate. As the catcher reached for the twirling ball, it glanced from his glove and bounded back to the stand, and the batter made second easily.

A center fielder saw a mit in the way of the shortstop and walked about sixty feet in to move it out of the way, when he heard the crack of the bat and saw a hot ball coming straight at him. He could do nothing but try to catch it, and did to his surprise. But he was given credit by the crowd for being a great student of batters.—Arthur Macdonald in *American Physical Education Review.*

The Court Quotes Scripture.—Mr. Justice Robb of the Court of Appeals of the District of Columbia illuminates his decision in the case of Brown v. Campbell by quoting from the Scriptures as follows:

"No man, when he hath lighted a candle, putteth it in a secret place, neither under a bushel, but on a candlestick, that they which come in may see the light." (St. Luke xi:33.)

And goes on to say that the man who secretes his invention makes easier and plainer the path of no one, contributes nothing to the public, and that over and over it has been repeated that the object of the patent system is through protection to stimulate inventions, and inventors ought to understand that this is for the public good.

THE UNIVERSAL

AN EDUCATION OR A TECHNICAL TRAINING FOR ANYONE, ANYWHERE AND IN ALMOST ANY SUBJECT

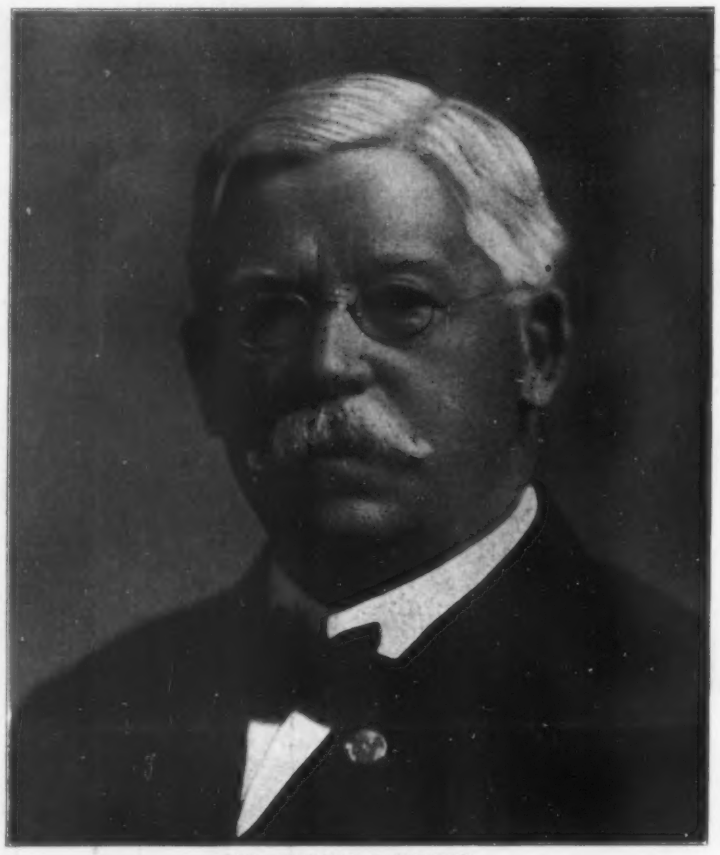
IT is not my purpose to offer any article or commodity for sale. What I am writing now to the intelligent American public has no commercial or financial end in view. One of the most remarkable educational and sociological institutions in the world's history has grown to international fame and power in our midst, and while multitudes of men have been benefited by it, the leaders of national thought and enterprise have so far failed to realize its importance as a national asset.

An institution that has become a big factor in enhancing industrial efficiency, that has increased the earning power of hundreds of thousands of men and has become a social and moral lever to innumerable families, is worthy of being understood.

Entirely free from the taint of charity, and without adding a mill of taxation to the over-burdened taxpayer, the International Correspondence Schools have succeeded in realizing many of the hopes and ideals of political economists and humanitarians. No thoughtful man should be willing to remain ignorant of the purpose, methods and achievements of this institution.

A Fruitful Humanitarian Impulse

The International Correspondence Schools had their birth in a humanitarian impulse. Twenty-five years ago, Mr. Thomas J. Foster, then proprietor and editor of *The Mining Herald*, of Shenandoah, Pennsylvania, was appalled by the number of mine tragedies in the anthracite coal regions. He believed they were due chiefly to ignorance on the part of the mine owners, superintendents and workmen. In order to furnish information to those engaged in the hazardous occupation of mining, Mr. Foster began a series of "Questions and Answers" in his paper. At that time, the only practical textbooks on the subject were published in England, and by means of their contents Mr. Foster answered the questions that soon flooded his columns. It was quickly discovered that miners, mine foremen, and superintendents were willing to pay for a more extended course of study if such were available.



MR. THOMAS J. FOSTER

With the help of competent engineers, Mr. Foster prepared a course of correspondence instruction in coal mining, and his first group of students began serious work twenty-two years ago. That successful beginning stimulated not only the humanitarian but the educational confidence of the editor of *The Mining Herald*, and from that day to this Mr. Foster has been constantly adding new courses of correspondence instruction, until now the International Correspondence Schools offer 275 courses of study—a far greater number and variety than any university in the world.

Sound Educational Basis

If the International Correspondence Schools had been an ordinary educational institution, they could have adopted textbooks prepared by class-room experts; but it quickly developed that to teach by correspondence required an entirely new method. The institutions that have tried to carry on instruction by mail based on the ordinary textbook have failed. The I. C. S. textbooks are designed to meet the need of the student studying at home. They take practically no previous knowledge for granted; they proceed by easy stages and lead the student forward by natural and carefully graded steps; they foresee and meet the difficulties of the student by copious explanations, demonstrations, and illustrations; they eliminate all irrelevant matter, giving only such instruction as is essential to the mastering of the subject; the lessons are in brief units so arranged that the student is relieved from overstrain.

ADMINISTRATION BUILDING, SCRANTON, PA.

These textbooks form a library of 250 volumes, and cost more than two million dollars ($2,000,000) to prepare. They are kept under constant revision, with a view to meeting the difficulties of the student and to convey the newest knowledge or the latest methods of application. The costs of preparing a few of the courses are here given: Architectural, $98,178.06; Civil Engineering, $88,887.19; Textiles, $76,532.09; Coal Mining, $74,075.06. This expenditure upon textbooks certainly points to a solid and permanent foundation for the International Correspondence Schools.

The value of these textbooks is attested by the fact that they have been purchased and are being used for classroom work or for reference purposes in 167 universities, colleges, government schools, institutes of technology and vocational schools in America. The University of California has just discarded its textbooks dealing with the strength of materials and has had the International Correspondence Schools instruction papers on that subject bound into volumes, and has adopted them exclusively for the use of its students. The U. S. Navy Department has ordered 15,000 I. C. S. pamphlet textbooks for use in the new naval shipboard schools. This is about one-fifth of what will be required when the schools are in full operation. Several of the largest industrial corporations of the country are using I. C. S. textbooks and instruction papers in the classes they have formed for the training of their apprentices and employes.

The Universal University

Has this outlay been justified? The answer is that the International Correspondence Schools have enrolled 1,651,765 students in the United States and Canada during the past twenty-two years, and are now enrolling new students at the rate of 100,000 a year. These figures are not given simply because they form an impressive total but for the reason that such an institution can only provide high-grade and efficient instruction when working on a large scale. For example, one of the courses of study—Electrotherapeutics—has a small enrolment because it is an advanced study for medical practitioners. The cost of conveying the instruction and correcting the papers results in a considerable loss each year to the institution. Salaries and overhead charges are just as great whether five or fifty papers are corrected per day. On the other hand, the Electrical Engineering Course has been taken by 224,188 students, and so it is possible to handle the students' work at the minimum cost.

In the place of classroom recitations, the student is required to send written answers to the School Examiners of the Instruction Department, the questions being designed to test the actual mastery of the subject by the student and cannot be answered by a mere formal copying of the text.

These papers are very carefully examined by the expert examiners, all errors are corrected, difficulties explained, and the principles and processes made clear if they seem obscure to the student. Marks are given for each grade of work, and no scholar is permitted to go on with his next lesson until the one upon which he is engaged is entirely satisfactory.

In order to prepare the student for serious work upon his course, he is required first to pass an examination upon a preliminary pamphlet, entitled "The Art of Study," in which he is taught how to study to the best advantage.

UNIVERSITY

BEING THE STORY OF HOW A HUMANITARIAN IMPULSE GREW INTO THE GREATEST TEACHING INSTITUTION ON EARTH

By JOSEPH H. ODELL, D.D.

Finding and Inspiring Students

While it may be acknowledged that advertising is one of the most important factors in modern life, it has been demonstrated that the International Correspondence Schools cannot secure enough students, even by means of the most elaborate and costly advertising, to insure the success of their enterprise, either upon humanitarian or commercial grounds. More than twenty years ago President Foster realized the force of Professor Huxley's statement: "*I conceive that two things are needful. On the one hand, a machinery for gathering information and providing instruction; on the other hand, a machinery for catching capable men wherever they are to be found, and turning them to account.*"

One of the chief differences between the regular college or university and the International Correspondence Schools lies in this: men who *want* an education *seek* the university, whereas the International Correspondence Schools *find* the men who *need* an education. No less than 1,346 agents of the Schools are scattered through the United States and Canada, whose one business it is to go into the homes, mills, factories and workshops to persuade men that they can be benefited by a course of instruction. These agents create ambition, stimulate hope, and preach self-reliance. They tell men, and they prove their point by innumerable examples, that they can make themselves more efficient in their present occupations or qualify themselves for other and more congenial and more remunerative occupations by a course of study at home and in their spare time. In this way they have personal interviews with tens of thousands of persons each week and the contact thus established results in inspiration and encouragement to multitudes who have lost hope in the hard battle for existence amid modern conditions. The International Correspondence Schools, as a part of their student enlistment work, also run instruction cars on a number of the most important railroads of the United States and Canada.

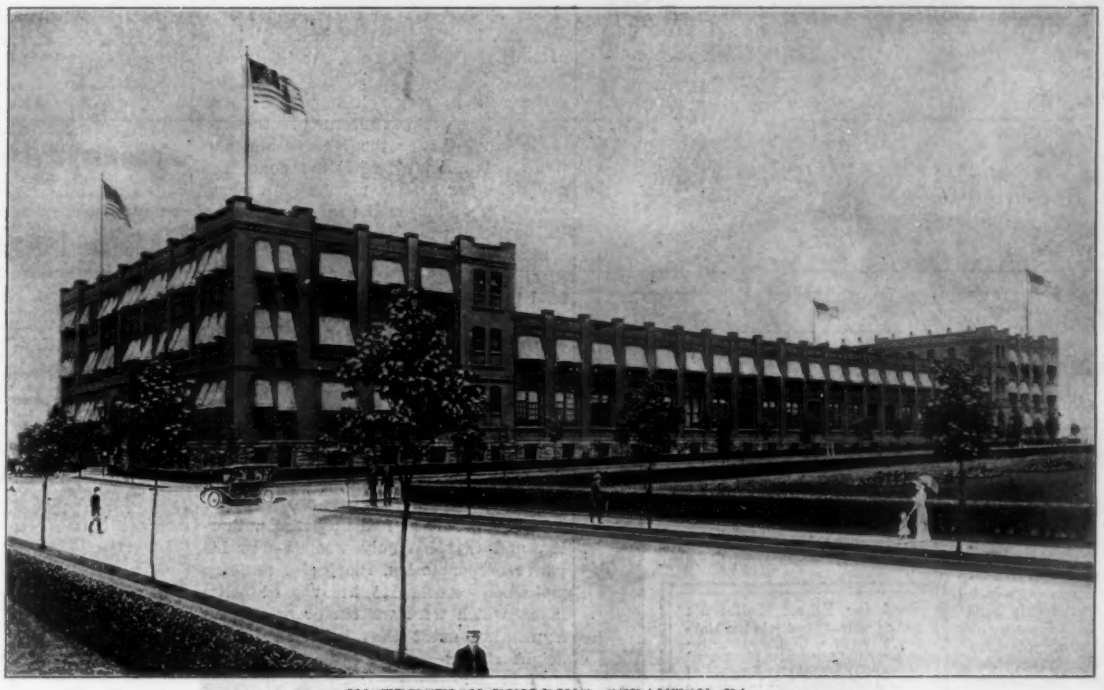
The cost of establishing and developing these agencies has been enormous, but the results have amply justified the investment from every standpoint. Up to the present the International Correspondence Schools have spent $1,703,965.20 in agency establishment, but the money thus invested must be regarded as necessary equipment just as much as the right of way cost of a railroad.

Keeping the Students Studying

No graver mistake can be made than to imagine that the International Correspondence Schools make a profit from lapsed students. Lapsing of students does not appreciably reduce the costs of the institution. As most of the enrolled students pay for their courses of instruction on the instalment plan, the profits of the enterprise come from the instalment payments of the students. A student will not continue to pay unless he continues to study, therefore it is the best business policy of the Schools to establish the study habit. Once a month, at least, the representative or agent of the Schools calls upon the student, not simply to collect the instalment due, but to offer encouragement, advice, and even assistance with his studies. This constant contact of the International Correspondence Schools with the student-body makes the institution a bona fide educational agency rather than a merely commercial enterprise, and insures a permanent future.

Indeed, no effort is spared to keep the student at his studies without intermission. Besides instructing the students in the most approved methods of acquiring knowledge prior to the first lesson of their course, and the periodic calls of the representative, a special department of encouragement and inspiration has been established by which sluggish or discouraged men are stimulated in their work. During the year 1913, no less than 805,079 individual letters were sent out to such persons, over and above 205,813 special letters dealing with particular difficulties encountered in the progress of their study. This resulted in an increase of 45 per cent. more study than was achieved before the department was put into force.

The International Correspondence Schools are faithfully, earnestly and persistently trying to convey instruction by every method known to pedagogy and psychology, and they are sparing no money in the effort.



INSTRUCTION BUILDING, SCRANTON, PA.

INTERNATIONAL CORRESPONDENCE SCHOOLS, LONDON, ENGLAND

Do the Students Profit?

Beyond a doubt. Every day the evidence accumulates and can be placed before any one who wishes to investigate. The International Correspondence Schools recently published a book giving the life history of 1,000 of their students, in each case furnishing the reader with the name, address, and occupation of the example cited. These were simply a cross-section taken from 26,000 letters, voluntarily sent to the institution, gratefully acknowledging the benefits received from the instruction of the Schools. It is no exaggeration to state that every city and fair-sized town, and almost every village in America, can furnish examples of men who have been lifted by this one institution from penury to comparative affluence, from obscure drudgery to honor and influence, from the precarious ranks of unskilled and ill-paid labor to positions as skilled mechanics, foremen, superintendents, manufacturers, and men of large financial affairs. In fact many very successful and well-known heads of big industries, engineers, architects, and corporation managers have been International Correspondence students, and have reached their positions of eminence by means of the instruction and training provided by this institution.

No one can possibly estimate the economic and social and moral part that the International Correspondence Schools have played in our complex national organism during the last two decades. Behind all statistics there are visions of a new and healthier and happier environment for multitudes of families.

World-Wide Extension

Fortunately, the International Correspondence Schools are on a firm financial foundation. They have done a gross business amounting to $85,753,140, and have distributed cash dividends amounting to $7,025,372, and stock dividends of $1,875,000. Besides this they own buildings valued at $1,159,280.29, copyrights and plates estimated to be worth $1,864,404.25, and behind it all a substantial surplus. This has enabled the International Correspondence Schools to become genuinely international. Added to their 3,400 employees in America, they have started a branch school in London which promises soon to rival its parent in this land. Already there is a staff of 400 instructors, textbook writers, and clerical employees in London, with 700 men engaged in selling scholarships in the British Isles. More than 100 men represent the I. C. S. in the British Colonies and the movement has the indorsement and co-operation of prominent English officials and educationalists. Branches are being organized in Central and Southern America, Mexico, France, Spain, and China, for which special textbooks are now being prepared.

The Man Who Feels, Sees and Does

President Foster is a man of deep feeling, clear vision, and prompt action. From his office in the Administration Building in Scranton, Pennsylvania, he directs the energies of nearly 5,000 persons who are dedicated to conveying education and technical training to those who need it in any part of the world—even to the remotest corners of the earth, to places where the name of America is hardly known. He is pouring out thousands of tons of educational and inspirational literature every year, every page of which he hopes will open the door of opportunity to some one who now feels doomed to poverty and obscurity for the lack of adequate educational training. When men awaken to the facts and all of their far-reaching consequences in the advance of civilization and social progress, Thomas J. Foster, Founder and President of the International Correspondence Schools, will be hailed as one of the greatest and most honored of modern benefactors and educationalists.—*Advertisement.*

The Martinsyde Transatlantic Challenger Monoplane

(*Concluded from page 24.*)

loaded, which was to have been sustained and impelled by the aerodynamic reaction of the planes and motive power against the air, and the force of gravity should have been close on to 5,000 pounds.

The tail was at the after end of the fuselage, and was of semi-circular form in plan, with a span of 21 feet. It had divided and balanced elevator flaps, and a balanced rudder of ample proportions.

It has already been mentioned that the machine was being constructed in duplicate, and it may be added that this duplication applied to the engine, since two separate, but identical engines had been put in hand, and both were to be sent to the starting point in Newfoundland, together with a very full supply of spare parts of the machine. Both engines were to be tuned up for the journey and one was to have been placed in the monoplane and the other kept in reserve as a measure of precaution, in the same manner as the duplicate wings and fuselage, etc.

Since the distance between Belle Isle Straits and the coast of Galway in Ireland is about sixteen hundred miles, and the aeroplane was expected to travel at 80 to 85 miles per hour, it was thought that the journey could be done in 20 hours during calm weather. A following wind would have materially increased the speed and shortened the time of the journey.

Eliminating a City's Filth and Flies

(*Concluded from page 29.*)

Knowing that he had no police authority, and that his only weapon was his power of persuasion, the junior sanitary policemen resorted to the use of polite notes, which were written or printed on a printing outfit that belonged to the neighborhood:

My Dear Mr. ————:

We are trying to make our school district flyless. Will you help us? Flies breed in fermenting lawn clippings, open garbage, and stable manure, if it is not removed at least once a week. We are writing this note to you because we are sure that you will help us.

Very truly yours,

————,
Junior Sanitary Police.

The girls also appealed to the merchants through notes in the same way:

My Dear Mr. ————:

Many people in our school district are refusing to buy food over which flies have crawled. Can we help you to keep a flyless store this summer? Very sincerely yours,

————,
Sanitary Aide.

Children took naturally to the work of cleaning their school district, for even boys and girls like to feel that their work is important. When conditions were met with which they could not cope, a plea for help written in a childish hand-writing and sent to the Street Cleaning Department was sure to bring assistance, whenever it was possible. Before the close of the school year streets were cleaned, alleys and vacant lots ceased to be dumping grounds for filth, and the rubbish from back yards gave way to gardens of flowers and vegetables.

New Aeronautic Records

THE French military dirigible balloon "Adjutant Vincenot," piloted by Georges Joux and carrying eight passengers, has made a new world's record for continuous navigation by dirigibles. It remained in the air for 35 hours and 20 minutes.

The German dirigible "Zeppelin L-3" established the previous record of 34 hours and 59 minutes in May in a flight from Friedrichshaffen to Berlin. The "L-3" measures more than 25,000 cubic meters; the "Adjutant Vincenot" 9,000 cubic meters.

The Germans still maintain the lead in aviation, particularly from the standpoint of duration. On the 28th ultimo Herr Landmann, with a 75 horse-power Albatross biplane, remained aloft, circling the Johannisthal aerodrome, for 21 hours and 49 minutes, thus adding well over three hours to the best previous record. He finally descended because of fatigue, and not from lack of fuel.

LEGAL NOTICES

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

AQUATIC DEVICES

SAFETY FIRST! Daily drownings warn bathers and sea travelers to carry the Auto-Pneumatic Swimming Belt. Not a toy. Pocket Life Preserver. Self-inflating. Weighs one pound. Illustrated booklet. Dealers or mail: 309 Broadway, N. Y.

AGENTS WANTED

SOBRINO HERMANOS, Casilla 183, Concepcion, Chile, desire to obtain the agency for Chile for good American products of practical use, as well as new inventions. Correspondence invited. Good references given and required.

AGENTS. 500% Profit. Free Sample Gold and Silver Sign Letters for store fronts and office windows. Any one can put on. Big demand everywhere. Write today for liberal offer to agents. Metallic Letter Co., 438 N. Clark St., Chicago, U.S.A.

BUSINESS OPPORTUNITIES

SUCCESSFUL COMPANY MANUFACTURING Light Machinery desires to add one or more new products, and will take over the manufacture and sale of any device that has proven its merit, and for for which there is a wide market. Address: Products, Box 773, New York, N. Y.

SIDE LINE SALESMEN, ATTENTION! This year's proposition the best yet. Get in touch with us at once for our live premium proposition. We guarantee our goods to sell, or take back unsold goods. Write today for full particulars. Canfield Mfg. Co., 208 Sigel Street, Chicago, Ill.

FOR SALE

NINE SUCCESSFUL CHEMICAL FORMULAS for sale. Suitable for manufacture on large or small scale. $20 to $50 each. What line interests, you? For particulars address Box 530, Atlanta, Ga.

PATENTS FOR SALE

IMPROVED Flat Hook and Eye Fastener. Patented in United States, Canada, England, Germany, France, Belgium. Want to sell on combined cash and royalty basis. Very reasonable. I. A. Hughes, 315 West Third Street, Santa Ana, Cal.

MISCELLANEOUS

MODEL AND EXPERIMENTAL WORK for inventors. We also make a specialty of manufacturing in small quantities, to try out a proposition. Metal or wood. All transactions confidential. Maroa Manufacturing Co., Maroa, Ill.

ROTARY PUMPS AND ENGINES

Their Origin and Development

An important series of papers giving a historical resume of the rotary pump and engine from 1588 and illustrated with clear drawings showing the construction of various forms of pumps and engines. 36 illustrations. Contained in Supplements 1109, 1110, 1111. Price 10 cents each. For sale by Munn & Co., Inc., and all newsdealers.

Technical Schools

READERS' SERVICE—Hardly a week passes but the Editor receives letters from readers of the Scientific American who ask him whether they shall send their boys to a technical school. Whether a boy shall become an engineer, a chemist or a naval architect are questions that puzzle parents. The Editor will be pleased to aid readers of the Scientific American in deciding the matter of technical education for their sons. Address: Educational Bureau.

—And You Can Buy This Lozier For $2100

Here is a ***new*** Lozier; a ***real*** Lozier; a ***big*** Lozier; a ***light*** Lozier—and for $2100.

New—from roof to tires—our latest series Four.

And ***Big***—bigger in body room than those famous "Big Fours and Sixes" we built in 1911 and 1912.

Seating seven—or five passengers in great comfort—allowing plenty of space per passenger.

Bigger than the "Big Six"—the last word in luxury—yet lighter, this Four, by some 700 pounds.

You know all too well what 700 pounds less weight will mean in tire bills, not to mention kindred savings in gasoline and oil.

We say "a Real Lozier" to correct the possibility of a mistaken impression. This low price of $2100 might be understood to indicate a departure in some measure from the standards of ability set by our $5000 and $6000 cars. Not so—everything that threw undying glamour around the great name and a great phrase, "The Choice of Men Who Know," is here in abundance.

Quantity production, and a consequent reduction in manufacturing over-head, allows us to offer you this new Four—a ***real*** Lozier—at $2100.

The old time Lozier power—and at $2100.

The old time Lozier vim and snap—and at $2100.

The old time Lozier safety—the safety that today brings famous racers to the Lozier factories to buy Lozier parts to install in their various cars—this old time safety—and at $2100.

The old time Lozier finish—the embellishments that lend a richness to the cars as years go by—and at $2100.

The old time ability to ***stay good***—to run year after year—year after year and grow sweeter with age—and at $2100.

The old time easy riding properties that come through spring alloys, which are one of the secrets of our business—easy riding as of yore—and at $2100.

A body that retains its newness—paint that stays fresh—upholstery that does not flatten down, sag, become bunchy, or wear out—and at $2100.

A heat treated frame—highest quality wood wheels—steering mechanism built in its entirety in the Lozier factories—a pressed steel gasoline tank made of one piece of metal and tested under enormous air pressure—and at $2100.

A four-cylinder Lozier motor—built by our own workmen in our own plants—designed by our own engineers—and tested six times by our own experts before it leaves the factory—and at $2100.

Everything considered, isn't this the car for you?

You may have thought of paying less—it will pay you to pay more and get this real Lozier for $2100.

Or perhaps you thought of paying more—if so, stop, investigate. Perhaps you can get the car you want for a smaller price—for $2100. UNLESS you are one of those so blest with worldly goods that you can live in the realm of the highest luxury and possess a good Six—a Lozier Six at $3250.

You can have your demonstration in the Lozier car of your choice—either the Four at $2100 or the Six at $3250.

May we send you catalog "S" giving full description and interesting details of this Four Cylinder Lozier—also the name of the Lozier dealer near you?

New Refinements

Long stroke vibrationless en bloc motor bore 4¼" stroke 6½"—wonderfully economical in gas and oil consumption
Four-speed transmission with direct drive on third speed
Tungsten steel valves
Gun iron pistons
Chrome-Silico-manganese springs
New Top—can be operated by a woman
Quick acting side curtains
Silent chain engine drive
Tire Pump—motor driven
Electric headlight dimmers
Instant locking rear tire carrier
Gray & Davis electric starting and lighting system
Corrugated hard rubber starting wheel
Full seven or five-passenger body with disappearing seats
36 x 4½ inch tires

LOZIER

Light Four $2100
Light Six $3250

Lozier Motor Company, Detroit, Michigan

Separate Running Gears and Bodies for Railway Cars

How One Inventor Meets the Increased Cost of Operating Trains

THE recent granting of a patent on railway cars for both freight and passenger service, issued under date of June 23rd, 1914, to James Harvey Wood, Jr., of New York city, discloses a proposed departure from present methods of car construction which has evidently been intended to meet the economic difficulties that confront the operation of great trunk lines.

The invention contemplates as a general principle of car construction, a railway car consisting of two separate and distinct units—a car carriage or running gear, and a car body. Any running gear of a given class, type or capacity may be used with any car body of a corresponding class, type or capacity. To this end these two units are so designed as to permit of the simple and quick removal of a car body from a running gear and of readily interchangeable usage of either with different running gears or with different bodies of the same respective types.

The running gear embodies trucks, draft member, couplings, and all equipment and appliances, including air-brakes, essential or incidental to the operation of the car as a train unit. Heating, lighting, and other equipment pertaining to the car body exclusively is attached to the body. Each unit will be designed for its particular functions. The car body will be designed for its load without the necessity of considering its strength in relation to its use as part of a train unit, as the running gear will be designed to meet that function. Therefore, the position of the car body, whether light or heavy, in the make-up of a train becomes of less consequence, since it is not a train resistance unit, and its running gear will be of proper and possibly standard strength for the various types or classes of running gear and respective bodies.

Without regard to the merit of the particular construction disclosed in this patent, the two unit or interchangeable running gear and body in railway car construction may afford a profitable solution of some of the most important and long-standing railway problems.

In general, a railroad may refuse to accept from another road a car that does not appear to be strong enough or in good enough repair to be operated over the receiving road with safety. In such a case the load is usually transferred to a car of the receiving road at the expense, including car rent, of the transmitting line.

In discussing the question many experts in car construction and operation, who attended the recent meeting of the Master Car Builders' Association at Atlantic City, took the position or expressed the opinion that no car of less than 80,000 pounds capacity should be accepted or operated in interchange, or in other words, through freight service, for the reason that most new car equipment is now being built of at least this capacity, and that cars of less strength, if operated with these heavier and stronger cars, become, through their comparative structural lightness and weakness, a source of constant repair, delays, and expense as well as of danger to property and life through the parting of trains or other accidents due to failure of equipment. It was brought out, on the other hand, that thousands of cars, many owned by private car lines, are in good condition and may be operated with safety and profit as originally designed, but not with the heavy modern cars which prohibit their use, thus practically wiping out the large capital investment in these cars. This argument was especially marked in relation to privately owned stock cars. Most of these cars are of a capacity of from 40,000 to 60 000 pounds, and it was mentioned that to impose a minimum capacity for interchange cars of 80,000 pounds, would be equivalent to confiscation of the property represented by these cattle cars.

As indicating the general misapplication of the term "capacity," it may be stated that it is impossible to load more than about 25,000 pounds of cattle in these cattle cars of 40,000 to 60,000 pounds capacity.

There are over 2,000,000 freight cars and 50,000 passenger cars in use on United States railroads. Nearly all great freight movements on these railroads are in what might be termed "season freight," or in other words, freight originating at certain times or seasons of the year, such as the crops; wheat, cotton, fruit, and others, and much of this freight requires a car of a more or less special type, that is unsuitable for other kinds of freight service.

In the two-unit construction only the special bodies need be idle, while running gears are employed with other bodies for which the demand exists.

There would doubtless be little difficulty or delay, upon the part of railroads, in reaching a common agreement on strength requirements for running gears, as the heretofore unreconcilable differences of opinion appear to relate to elements of the car body as a receptacle, such as dimensions and construction features. Any car body of present construction could be made properly to engage and operate with a separate running gear of agreed standard strength and build.

In this case a cattle car body that could not be loaded with more than 25,000 pounds of cattle need not be built of a minimum capacity of 80,000 pounds, as has been advocated, since the running gear would meet the standard requirements while the body need merely possess the desired carrying capacity, with of course a proper margin of structural strength over the demands of its usage as designed.

A standard and separately constructed running gear would be of equal use to all railroads, when freight is available, and therefore syndicate ownership of running gears with separate, or individual, road ownership of car bodies adapted to engage and operate with these gears, but otherwise of a type desired by the respective roads, should prove a feasible and economical plan of joint ownership.

Passenger trains on the railroads of the United States traversed last year a total of over 580,000,000 miles or, under the arbitrary estimate of an average of five cars to each train, a passenger car mileage of over two billion nine hundred million miles. Likewise, under the arbitrary estimate of twenty cars to a train, the freight car mileage is indicated to have been over twelve billion miles, or a total car mileage roughly estimated at fifteen billion.

Again taking an arbitrary estimate of one cent as the average cost of hauling a weight of one ton one mile, it appears that the accomplishment of a saving, or reduction, of one ton in the average weight of all railroad cars, would mean an actual cash saving, based upon the above-stated arbitrary assumptions, of $150,000,000 a year to the railroads of the United States.

The Internal Combustion Motor in the Field of Aviation

THAT the heavier-than-air flying machine would have been possible without the internal combustion motor seems probable, to judge by Langley's efforts, which came so very near actual success. But it would have been a severe handicap had the Wright brothers and their successors not been able to profit by the development of the light-weight internal combustion motor in the automobile industry. The present status of the aeroplane motor, and a forecast of its future development, forms the subject of a comprehensive paper recently read by Howard Huntington, secretary of the Aero Club of America, before the New Haven meeting of the American Society of Mechanical Engineers. This paper, with numerous illustrations, is reproduced in full in this week's issue of our SUPPLEMENT.

Instructive Electrical Books

A selected list of books treating on electrical subjects, including electric wiring, induction coils, telephony, wireless telegraphy, etc.

Design and Construction of Induction Coils

By A. FREDERICK COLLINS. 6½x9¼. Cloth. 272 pages, 159 illustrations. Price, $3.00.

¶ This work gives in minute details full practical directions for making eight different sizes of coils, varying from a small one giving one-half inch sparks to a large one giving twelve-inch sparks. The dimensions of each and every part are given, and the directions are written in language easily comprehended.

Complete Electrical Library

By T. O'CONOR SLOANE, A.M., E.M., Ph.D. 5 volumes, 5¼x7¼. Cloth. Price, $5.00.

¶ An inexpensive library of practical and instructive books on electricity for the student, amateur, electrical engineer, the workshop, schools and colleges. The titles and prices of the volumes, when sold separately, are as follows:

Arithmetic of Electricity
162 pages. $1.00.

Electricity Simplified
174 pages, 32 illustrations. $1.00.

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210 pages, 77 illustrations. $1.00.

How to Become a Successful Electrician
205 pages, illustrated. $1.00.

Standard Electrical Dictionary
682 pages, 393 illustrations. $3.00.

Special Offer—We will send, by mail or express prepaid to any address in the world, the above five volumes, handsomely bound in blue cloth with silver lettering, and enclosed in a neat folding box, at the special reduced price of $5.00 for the set.

Telephone Construction, Installation, Wiring, Operation and Maintenance

By W. H. RADCLIFFE, E.E., and H. C. CUSHING, JR., E.E. 4½x6¾. Cloth. 223 pages, 132 illustrations. Price, $1.00.

¶ Describes up-to-date methods of telephone practice, including the principles of construction and operation of telephone instruments; approved methods of installing and wiring them; the means of protecting them from lighting and abnormal currents; their connection together for operation as series or bridging stations; and rules for their inspection, repair and maintenance.

Wireless Telegraphy and Telephony Simply Explained

By ALFRED P. MORGAN. 5¼x7½. Cloth. 154 pages, 156 illustrations. Price, $1.00.

¶ A popular, practical and simply worded treatise, embracing complete and detailed explanations of the theory and practice of modern radio apparatus and its present-day applications. It is written so that it can readily be understood by men who are not technical, and at the same time is sufficiently comprehensive and practical to be studied advantageously by the ambitious young engineer or experimenter.

Practical Electricity

By T. O'CONOR SLOANE, A.M., E.M., Ph.D. 4⅝x6¼. Flexible cloth. 761 pages, 556 illustrations. Price, $2.50.

¶ This manual, formerly known as Sloane's "Electricians' Handy Book," is a self-educating work on electricity and covers the entire field of practical electrical engineering. It is popularly written and may properly be termed an Elementary Text Book of Electricity. It presents the essentials of the science, with a sparing use of the simplest mathematics, and tells the practical working electrician just what he wants to know. It is a practical book for the practical man.

House Wiring

By THOMAS W. POPPE. 4¼x6½. Flexible cloth. 103 pages, 74 illustrations. Price, 50 cents.

¶ Describes and illustrates the actual installation of electric light wiring, the manner in which the work should be done and the best up-to-date methods of doing it. It gives just the information essential to the successful wiring of a building, without being too technical or overladen with details and contains nothing that conflicts with the rulings of the National Board of Fire Underwriters.

Electric Wiring, Diagrams and Switchboards

By NEWTON HARRISON, E.E. 5¼x7½. Cloth. 272 pages, 105 illustrations. Price, $1.50.

¶ A practical work of ready reference for the wireman, foreman, contractor, electrician and all others interested in the application of electricity to illumination and power. It covers the subject of electric wiring in all its branches. Direct and alternating current wiring are both fully treated.

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Alloys

The Scientific American Supplement has published from time to time excellent papers on alloys written by the foremost authorities. Since many of our readers may wish to refer to these, we give below a list of the more important:

Valuable Alloys. A series of practical recipes covering the making of sheet brass, mosaic gold, French cast brass, bronzes of all kinds, platinum alloys, bell metals, imitation gold, white metal, alloys of copper and arsenic, Britannia metal, alloys of lead and tin, speculum metal; in a word, all alloys that have any industrial importance. Scientific American Supplement Nos. 1576, 1580, 1582, 1584, 1596 and 1597.

Steel and Its Treatment. Changes in Physical Properties Due to Variation of Alloys. By Robert R. Abbott. Scientific American Supplement No. 1899.

Bearing Metal Manufacturing and Its Use. The Characteristics of Metals used for Bearings. By L. D. Allen. Scientific American Supplement No. 1998.

Some Properties of Vanadium Steel. How small quantities of vanadium affect different mixtures of iron and steel and where it is most useful. Scientific American Supplement No. 1638.

Some Hints on Melting Metals and Alloys. Scientific American Supplement No. 1613.

The Art of Making Alloys. By Percy Longmuir. Some Suggestions of Practical Importance. Scientific American Supplement No. 1732.

Some Alloys Suitable for Instrument Work. Scientific American Supplement Nos. 1936 and 1937.

Iron, Gold, Silver and Tin Amalgams. Formulas for making and using them. Scientific American Supplement Nos. 1564 and 1729.

Iron, Vanadium and Carbon in Steel. Their chemical and mechanical relations. Scientific American Supplement No. 1910.

The Forging of Alloy Steels. The metallurgy of the newer alloys. Scientific American Supplement No. 1663.

Automobile Steels. Their use in motor car construction. Scientific American Supplement Nos. 1747 and 1748.

Steel Hardening Metals. Scientific American Supplement No. 1535.

The Pyrophoric Alloy Industry. Modern Substitutes for Flint and Steel. These alloys possess the extremely remarkable property of giving rise when struck to such brilliant sparks that cigars, cigarettes, gas and other combustible substances may be readily lighted by their aid. These alloys have now been placed on the market as successful substitutes for matches. Scientific American Supplement Nos. 1885 and 1977.

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What Users Say:

We constantly receive appreciative letters from users of Gargoyle Mobiloils. Below we quote from a few typical letters. Each bears on a different problem.

Low Cost per Mile

"I find that the consumption is about one-half as much per mile as any other oil I have used."—From a Ford owner who uses Gargoyle Mobiloil "E."

Freedom from Carbon

"Have run 30,000 miles and never had a valve touched nor carbon cleaned out of cylinders; engine runs perfectly and seems good for 30,000 miles more."—From a Hupmobile owner who uses Gargoyle Mobiloil "Arctic."

Overheating Stopped

". . . We are no longer troubled with overheating; the motors develop more power and run with less noise."—Operator of Kelly-Springfield and Vulcan trucks who uses Gargoyle Mobiloil "A."

Hard-run Motors

"Before we adopted Gargoyle Mobiloil "Arctic" we made a thorough test of it and found it worth the difference over cheap oils. By this we mean the great mileage obtained with the highest efficiency from our motors and less carbon. This means less wear and tear on our hard-run motors."—Manager of a large taxicab company.

Second-hand Value

The Vice-president of a large automobile clearing house writes:

"During the past twelve months we have carefully inspected and overhauled about three hundred used automobiles.

"The second-hand value of a large percentage of these used cars would have been greater if the former owners had given the matter of correct lubrication more careful attention. We are using Gargoyle Mobiloils and recommend them."

* * * *

The various grades of Gargoyle Mobiloils, purified to remove free carbon, are:

Gargoyle Mobiloil "A"
Gargoyle Mobiloil "B"
Gargoyle Mobiloil "E"
Gargoyle Mobiloil "Arctic"

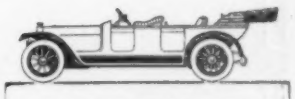
They can be secured from reliable garages, automobile supply houses, hardware stores, and others who supply lubricants.

The Lubricating Chart on the right will show which grade to use on your car. A copy of our complete Chart will be sent you on request.

It is safest to buy in original barrels, half-barrels and sealed five and one-gallon cans. See that the red Gargoyle, our mark of manufacture, is on the container.

On request we will send a pamphlet on the Construction, Operation and Lubrication of Automobile Engines. This pamphlet describes in detail the common engine troubles and gives their causes and remedies.

For information kindly address any inquiry to our nearest office. The city address will be sufficient.



Correct Lubrication

Explanation: In the schedule, the letter opposite the car indicates the grade of Gargoyle Mobiloil that should be used. For example: "A" means "Gargoyle Mobiloil A." "Arc" means "Gargoyle Mobiloil Arctic." For all electric vehicles use Gargoyle Mobiloil "A." The recommendations cover all models of both pleasure and commercial vehicles unless otherwise noted.

MODEL OF CARS	1910 Summer	1910 Winter	1911 Summer	1911 Winter	1912 Summer	1912 Winter	1913 Summer	1913 Winter	1914 Summer	1914 Winter
Abbott Detroit	A	Arc.	A	Arc.	A	Arc.	A	Arc.	Arc.	Arc.
Alco	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	...	...
American	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Autocar (2 cyl.)	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
" (4 cyl.)	A	E	A	Arc.	A	Arc.	...	...	...	...
Avery	A	E	A	E	A	A	A	A	A	A
" (Model C)	...	...	...	...	...	...	...	...	Arc.	Arc.
Buick (2 cyl.)	A	A	A	A	A	A	A	A	...	...
" (4 cyl.)	Arc.	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
" (6 cyl.)	...	...	...	...	...	...	...	...	A	Arc.
Cadillac	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Cartercar	A	E	A	E	A	E	A	E	Arc.	Arc.
" Com'l.	A	E	A	Arc.	A	Arc.	A	Arc.	...	...
Case	...	...	A	A	A	Arc.	A	Arc.	A	Arc.
Chalmers	Arc.	Arc.	A	Arc.	Arc.	Arc.	Arc.	Arc.	A	A
Chase (air)	B	B	B	B	B	B	B	B	B	B
" (water)	...	...	...	...	...	...	...	...	Arc.	Arc.
Cole	Arc.	Arc.	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Delaunay-Belleville	B	A	B	A	B	A	B	A	B	A
E. M. F.	Arc.	Arc.	Arc.	Arc.	Arc.	...	...	...	...	...
Empire	A	Arc.	A	Arc.	A	Arc.	A	Arc.	Arc.	Arc.
Fiat	A	A	B	A	A	A	B	A	B	A
Flanders	E	E	E	E	Arc.	Arc.	...	...	...	...
" (6 cyl.)	...	...	...	...	...	...	Arc.	Arc.	...	...
Ford	A	Arc.	E	E	E	E	E	E	E	E
Franklin	B	Arc.	A	Arc.	A	Arc.	A	Arc.	A	A
" Com'l.	B	A	B	A	A	Arc.	A	Arc.	...	...
G. M. C. Truck	...	...	...	...	Arc.	Arc.	A	Arc.	A	Arc.
Havers	...	...	A	Arc.	A	Arc.	A	Arc.	A	A
" (Model 6-60)	...	...	...	...	...	...	...	...	Arc.	Arc.
Haynes	A	E	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Hudson	Arc.	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Hupmobile (Model 20)	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	...	...
" (Model 32)	...	...	...	...	...	...	A	Arc.	A	Arc.
I. H. C. (air)	...	...	...	...	...	...	B	A	B	A
" (water)	...	...	...	...	...	...	A	A	A	A
International	B	A	B	B	B	A	...	...	...	...
Interstate	A	E	A	Arc.	A	Arc.	A	Arc.	...	...
Jackson (2 cyl.)	A	A	...	...	...	...	...	...	...	...
" (4 cyl.)	A	Arc.	A	Arc.	A	Arc.	A	Arc.	Arc.	Arc.
" (6 cyl.)	...	...	...	...	...	...	...	...	Arc.	Arc.
Jeffery	...	...	...	...	...	...	...	...	A	A
" Com'l.	...	...	...	...	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Kelly	...	...	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	A
King	...	...	A	E	A	E	A	E	A	A
" Com'l.	...	...	...	...	...	...	...	...	Arc.	Arc.
Kissel Kar	A	E	A	Arc.	A	Arc.	A	Arc.	Arc.	Arc.
" " Com'l.	...	...	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" " (Model 48)	...	...	...	...	...	...	...	...	A	A
Kline Kar	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.
Knox	B	A	B	A	B	A	B	A	B	A
Krit	A	A	A	A	A	A	A	A	A	A
Locomobile	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	E	E
Lozier	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.
Mack	A	E	A	E	E	E	E	E	A	E
" (Model B)	...	...	...	...	...	...	...	...	A	E
Marion	A	E	A	E	A	Arc.	A	Arc.	Arc.	Arc.
Marmon	A	E	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Maxwell (2 cyl.)	E	E	E	E	D	E	...	...	...	...
" (4 cyl.)	E	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" (6 cyl.)	...	...	...	...	...	...	Arc.	Arc.	Arc.	Arc.
Mercer	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Mitchell	Arc.	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Molins	A	E	A	Arc.	A	Arc.	A	Arc.	...	...
Merlin Knight	...	...	...	...	...	...	...	...	A	A
Moon (4 cyl.)	A	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.
" (6 cyl.)	...	...	...	...	...	...	...	...	Arc.	Arc.
National	A	A	A	A	A	A	A	A	A	A
Oakland	A	E	A	Arc.	A	Arc.	A	Arc.	Arc.	Arc.
Oldsmobile	A	E	A	Arc.	A	Arc.	Arc.	Arc.	Arc.	Arc.
Overland	A	E	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Packard	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.
Paige Detroit	E	E	A	Arc.	A	E	A	E	A	A
Pathfinder	...	...	...	...	...	...	A	Arc.	Arc.	Arc.
Peerless	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Pierce Arrow	Arc.	Arc.	A	Arc.	A	Arc.	Arc.	Arc.	Arc.	Arc.
" Com'l.	...	...	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Pope Hartford	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Premier	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Rambler	A	E	A	Arc.	Arc.	Arc.	Arc.	Arc.	...	...
Regal	A	E	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Renault	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Reo	A	E	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Saxon	...	...	...	...	...	...	...	...	E	E
S. G. V.	...	...	B	Arc.	B	Arc.	B	Arc.	A	Arc.
Selden	A	E	A	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Simplex	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Speedwell	Arc.	Arc.	A	Arc.	A	Arc.	Arc.	Arc.	Arc.	Arc.
" Mead	...	...	...	...	...	...	A	Arc.	B	A
Stearns	Arc.	Arc.	A	Arc.	A	Arc.	...	...	...	...
" Knight	...	...	...	...	A	A	A	A	B	A
Stevens Duryea	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Studebaker-Dayton	Arc.	Arc.	A	A	A	A	A	A	...	...
" Knight	...	...	...	...	A	A	A	A	...	...
Studebaker	E	E	A	Arc.	Arc.	Arc.	A	Arc.	A	Arc.
Stutz	...	...	...	...	Arc.	Arc.	Arc.	Arc.	A	A
Velie (4 cyl.)	A	E	A	Arc.	A	Arc.	A	Arc.	A	Arc.
" (6 cyl.)	...	...	...	...	...	...	...	...	Arc.	Arc.
Walker	A	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
White	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Winton	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.

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A grade for each type of motor

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Specialists in the manufacture of high-grade lubricants for every class of machinery. Obtainable everywhere in the world.

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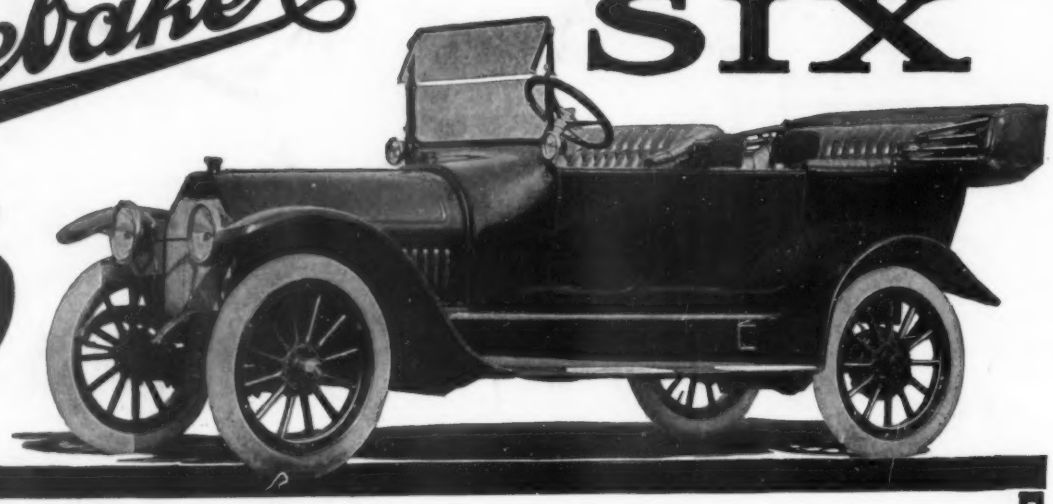


More Than One Hundred Heat Treating Processes Perfect Studebaker Steels

Studebaker roadability goes clear back to the sampling and testing and heat treating of Studebaker steels---long before the car is built.

But the result is made perfectly plain the first time you take a ride, in the wonderful way it holds the road.

You realize in that very first ride that the Studebaker laboratory has not labored in vain.

As the beautiful balance of the car reveals itself, you know that the chemical, metallurgical and physical tests, have accomplished their purpose.

And, in due time, the longer life and the lesser cost demonstrate beyond a doubt, that more than a hundred Studebaker heat treating processes have increased the value of its steels, far beyond the ordinary standards.

Studebaker is committed to the principle of a "Six" manufactured by themselves in all essential parts, except a few patented specialties and some equipment.

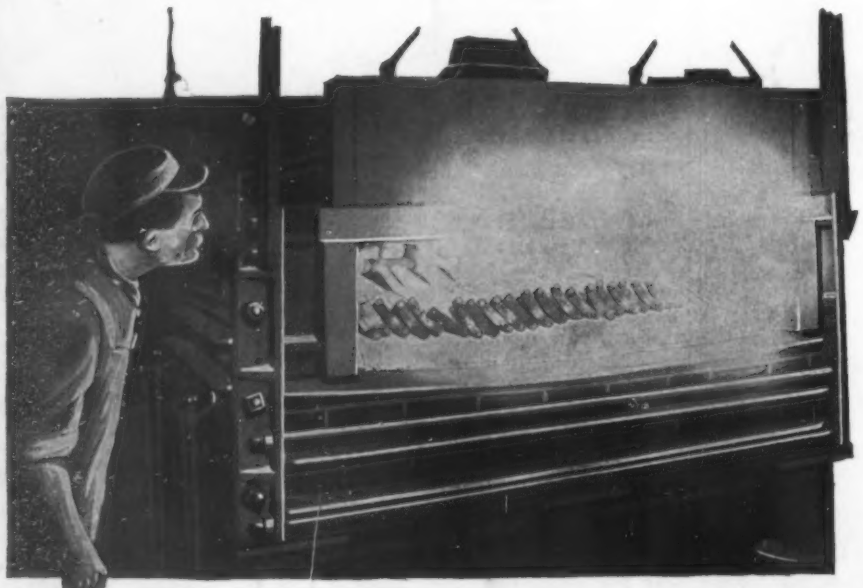
Studebaker believes that the ease, the long life, the balance, the roadability of a motor car is in direct relation to the proportion of closely manufactured parts produced by the maker of the car himself.

Studebaker believes that every buyer should investigate the proportion of such parts in every "Six" he considers.

In such a test the weight of evidence will be overwhelmingly in favor of the Studebaker SIX.

The Studebaker Proof Book describes and pictures the scientific manufacturing operation of Studebaker. Send for it.

STUDEBAKER
Detroit



One of more than one hundred heat treating processes used in 142 Studebaker treating ovens.

The Full Floating Rear Axle
Full Timken Bearing Equipment
24 Body Finishing Operations
Electrically Lighted and Started
Completely Equipped

F. O. B. Detroit

FOUR Touring Car	$1050
SIX Touring Car	1575
SIX Landau-Roadster	1800
SIX Sedan	2250

F. O. B. Walkerville

FOUR Touring Car	$1375
SIX Touring Car	1975
SIX Landau-Roadster	2350
SIX Sedan	2950

Canadian Factory: Walkerville, Ont.

"Quantity Production of Quality Cars"